Basics of Computer Science

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Computer Science

Includes
Solution For Lab Assignment
&
Viva Question Bank

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Computer Application Theory

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Computer Application Theory

CHAPTER 1

Introduction To Computer

Calculations have always been part of man's life. Be it his personal life or professional work in office, he has to perform calculations. Without calculations he cannot lead a normal life.

It has always been man's desire to perform all the calculations correctly, effortlessly and at very fast speed. For this, he has been continuously evolving new mechanisms and building better tools for calculations.

Ever since ancient time, a technological race has been set up between the complexity of the problems and calculation capabilities of calculating devices.

In this race both the runners have tried their best to stay ahead of each other. Whenever complexity of the calculations takes stride, a machine with more capabilities and power comes into existence. But at the same time, with the advent of new machines, complexity grows multi fold to place new challenges before the machine.

Thus in this race, many calculating devices came into existence and became obsolete, within short period of time.

The race has not yet finished, but to meet the challenges of contemporary complexity, computer in its most powerful form is available for use. There is hardly any sphere of life left today, in which computers are not being used. But unattended complexities are still demanding for more capable machines.

In this chapter, we will take a close look on the development of computer, which has taken place over past so many years.

HISTORY OF COMPUTER

Computers of today are quite powerful, sophisticated and very fast. They were not so in their earlier stages. In fact they have traveled a long distance from primitiveness to sophistication. They took many years to reach the present stage.

Ancient people used pebbles for counting and made scratches on the wall to keep track of their belongings. For example, ten scratches on the wall represented ten goats that they had. After that two new scratches nearby used to be clear indication of two new additions made in the fleet.

As they became bit wise, they made use of the objects nearby them and made counting and calculating devices. For example, long time ago they collected wires, wood and beads from here and there and made the first counting device, called Abacus. As the time passed, many computing devices got developed. After lot of advancements and improvements calculating devices reached the stage of modern computer. Ever since the birth of abacus, calculating devices have been making continuous progress. A brief historic development of these devices is given below.

Abacus

Around 1000 years before the birth of Jesus Christ the Mesopotamians quite unknowingly laid the foundation of computer era. They made a device of stones sand and pebbles, called Abacus. It was mainly used for counting.

Later reforms were made in Abacus. Straight wires were fixed in a wooden frame and small beads were put in the wires. Beads could be moved along the length of the wire. Mathematical calculations like addition, subtraction,

Figure 1.1

multiplication and division could be performed using new Abacus. Abacus is shown in figure 1.1.

Abacus is still being used today. Children are taught counting, using Abacus in schools. Many shopkeepers in Asia and "Chinatown" in North America, still make use of it for calculating the total payable amount for the articles sold by them.
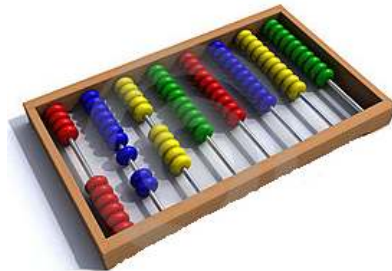
Napier's Bones

John Napier was a Scottish mathematician who lived from 1550 to 1670. He worked for more than 20 years to develop the theory of tables, which became quite famous, with the name Logarithmic Tables.

Towards the end of his life, John Napier devised set of rods, called Bones, because they were constituted from bones. Digits were printed on them. Napier's rods essentially transformed the process of complex multiplication and division into much simpler tasks of addition and subtraction.

Napier's Bones are shown in figure 1.2. Refer this figure and note that each rod contains ten squares. The first square has the serial number of the rod written in it. Remaining nine squares are bisected by a diagonal, leaving aside the first square. The nth square in it contains the result of multiplication of rod number by

Figure 1.2

n. So that the upper triangle of the square contains the most significant figure and the lowest triangle contains the least significance figure. For example, the third square in fifth rod will have 15 in it.
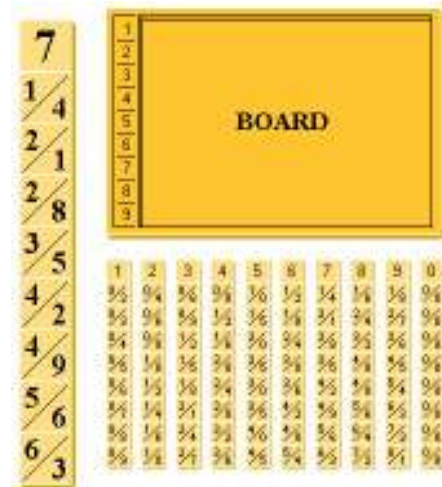
Now let's multiply 786 x 3. The 3rd square in 6th rod contains 18. So 18 will be at unit place of the product. Similarly, third square of the 8th rod contains 24. Thus 24 will be at 10th position. Third square of 7th rod contains 21. Thus 21 will be at 100th position. Thus we get:

```
7X3 =   21
8X3 =   24
6X3 =     18
          2358
             unit
             10th
             100th
             1000th
```

Slide Rule

Slide rule was once-upon-a-time favorite mechanical device that
was quite often used for performing complex and complicated calculations at very fast speed. Using slide rule mathematical, statistical and engineering calculations are performed with ease. For doing all these calculations, it makes use of logarithmic tables that were invented by John Napier in 1941.

The **slide rule** consists of a pair of finely divided fixed scales. Most often, outer pair of scales is fixed and inner scale is movable. A sliding window called cursor is put around the scales.

In slide rule, all the calculations are done by sliding the scales and the cursor. This is the reason why it drives its name slide rule.

Before the advent of pocket calculator, slide rules were quite popular. From 1950 to 1960, they were seen as the best available tool for calculations. When computers became popular and pocket calculator became cheap, their use became limited.

Figure 1.3

Pascal's Calculator

Blaise Pascal was a French mathematician, physist and theologian. He was the son of tax collector. His father had to do lot of additions and subtractions, in which he quite often made errors.

At the age of 18 in the year 1840 Pascal started developing a mechanical device, using which arithmetic operations like addition and subtractions could be done very easily. The first operating model was introduced in 1942.

This machine was called Arithmetic Machine. Later Pascal created 50 more machines, over next 10 years.

Later this machine was called, Pascal's Adding Machine. It is shown in figure 1.4.

Pascal's adding machine was built on a brass rectangular box where, a set of notched dials moved internal wheels, in such a way that a full rotation of a wheel caused the wheel, at the

left to rotate one tenth. Although the first prototype contained only 5 wheels but later, units with 6 and 8 wheels were also made.

The wheels of the machine moved only clock wise and were designed to perform additions. Subtraction was done by applying a cumbersome technique, based on addition of the nine's complement.

The biggest disadvantage of this machine was that operations like multiplication, division etc. could not be done through it.
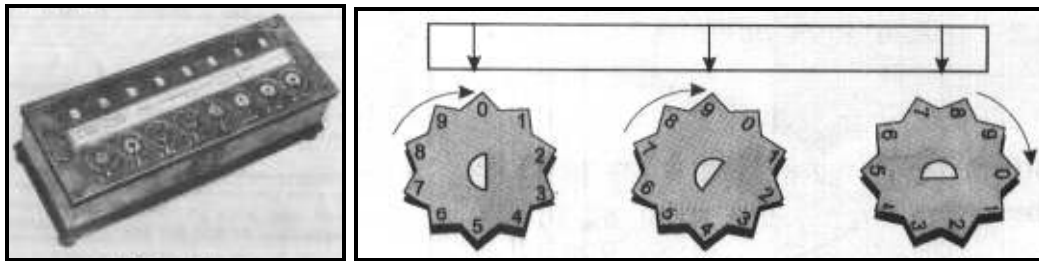
Figure 1.4

Leibniz's Calculator

A German mathematician, whose name was Gottfried Leibniz, improved the adding machine, developed by Pascal. This new machine, which he constructed in year 1671, was able to multiply and divide as well. The concept of multiplication was to repeatedly add the same number to itself. Instead of using wheels in his machine, he used stepped-cylinders, each with nine teeth of varying lengths. Leibniz's Calculator is shown in figure 1.5.

Figure 1.5

Jacquard's Loom

A French weaver Joseph Jacquard invented an automated loom in 1804. This loom used punched cards to produce patterns and designs on cloth. The weaving action of this machine was totally governed by the absence or presence of holes in the cards. In other words, you can say that the entire operation was under a program's control. With this, historic invention of punched cards, the era of storing and retrieving information started that greatly influenced the later inventions and advancements of computing devices.

Figure 1.6

Babbage's Difference Engine

In year 1822, Charles Babbage, a professor of mathematics developed a machine called Difference Engine. This machine was able to calculate logarithms up to high precision degree. It had capability to calculate different functional values and could also calculate polynomials by finite difference technique.

Figure 1.7

Babbage's Analytical Engine

Charles Babbage started working on a device named Analytical Engine in year 1833. This Analytical Engine was in real terms the ancestor of modern computer. The Analytical Engine was able to perform all four arithmetic operations. It was conceptualized around processor, storage area, memory and input/output devices. The two revolutionary inventions in Analytical Engine were comparison and modification of stored information. This was the first invention, which enabled machine to compare quantities and then decide which of the instruction sequence to follow. Due to lack of technology at that time, it was not possible for Babbage to build such an engine. Its design remained conceptual. His great invention of Difference Engine and Analytical Engine earned Charles Babbage the title Father of Modern Computers - a suitable tribute to him.

Figure 1.8

Hollerith's Machine

The dream of Charles Babbage was fabricated by an American, named Herman Hollerith (1869-1926). In year 1887 he fabricated the first electromechanical punched card tabulator that used punched cards for input, output and instructions. This machine was used by American department of census to compile their 1880 census data and was able to complete compilation in 3 years, which earlier used to take around 10 years.
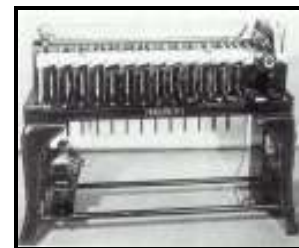
Figure 1.9

Mark-1

Prof Howard Aiken (1900-1973) of U.S.A constructed an electromechanical computer named Mark-1 in year 1943. Mark-1 had capability to multiply two 10-digit numbers in 5 seconds, which was a record at that time. Mark-1 was the first machine, which could perform according to pre programmed instructions automatically without any manual interference. This was the first operational general-purpose computer.
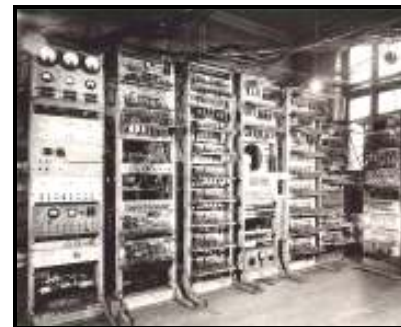
Figure 1.10

ENIAC

The defense department of USA was supposed to design advanced weapons, missiles and aircrafts. For this, they had to do lot of complex calculations. This process was not only time consuming but was error prone also. To do this work efficiently, in 1946, scientists of Pennsylvania University designed a new computer.

This computer was 20 feet long and 40 feet high. It consumed as much electric power as was sufficient to light a small city. But this machine was much faster than any earlier machine. It was

Figure 1.11

capable of doing more than 5000 additions, subtractions or 350 multiplications and divisions in a second. This machine was called ENIAC. **ENIAC** is acronym for **Electronic Numerical Integrator and Computer.** The biggest problem with this computer was that all the instructions were hardwired within the computer. Thus making modifications in instructions was a very difficult task. This problem was removed from the computers, which came after this computer.

EDVAC

EDVAC is acronym for **Electronic Discreet Variable Automatic Computer**. It was designed and created in 1950 in Moore school of America. It was capable of taking instructions from external resources. Data and instructions, both could be provided to it, using punched cards. Thus problem of hardwired instructions, which

Figure 1.12

was there in ENIAC, was solved in this computer. Its performance was much better than earlier computers.

Modern Computer

In the year 1981, IBM developed a modern computer. It was small in size but very powerful. Its functioning was very simple. This computer was called **Personal Computer** or **PC**. It became popular very soon. After 1981 lot of improvements were made in PC. These improvements made PC very powerful and easy to operate. Personal Computer's functioning has now become so simple that even a child can operate it.

Figure 1.13

GENERATIONS OF COMPUTER

Computer being an electronic device, its size, capabilities and power at any time are greatly influenced by the existing state of electronics of that time.

If electronic components and devices of any time were big, slow and unreliable then computers of that time were also big, slow and unreliable. On the other hand fast, reliable and smaller electronic components made the computers small, reliable and fast in operations.

You know that technological developments of electronics passed through few major phases. For example, there was a time when vacuum tubes were quite popular. They were freely used in majority of electronic equipments. After some time, they were replaced by transistors. Later Integrated Circuits came and set a new path for electronic developments.

Computers of specific electronic era are often referred to as a generation. Various generations of computer that came into existence, are described below.

First Generation Computers (1942-1955)

First generation computers were voluminous in size. **They were made using vacuum tubes**. Vacuum tube was a fragile glass device that could control and amplify electronic signals.

First generation computers used the idea of execution of stored programs. Following were the main drawbacks of first generation computers:

1. Their size was very large.
2. Speed of instruction-execution was very slow.
3. They generated lot of heat.
4. Switching through vacuum tubes was not reliable.
5. Heavy air conditioning was required.
6. Only scientists and engineers were able to use these computers and that too in limited areas due to their high cost.
7. They needed a constant maintenance, which was very expensive.

Figure 1.14

Some of first generation computers are ENIAC, EDSAC and UNIVAC I etc.

Second Generation Computers (1955-1964)

Transistor was invented as a smaller and more reliable successor of the vacuum tube. Although transistor was invented in 1948, its application in computers started in the year 1958. The transistor was more reliable, less expensive, and smaller than the smallest vacuum tube. It consumed very little power and produced much less heat.

Figure 1.15

A transistor is also called a solid-state device. It is made of a material whose principal part is silicon element. It is also called semiconductor device. It performs all the functions of a

vacuum tube i.e. switches circuit on and off at a very high speed. **Second generation computer made use of transistors.**

Apart from the above listed advantages, the second generation computers used better devices such as card readers, printers etc. This generation is also important from the point of view of language development and use. First generation computers used machine level language or low-level language i.e. program was written directly in binary digits, which was very cumbersome and tedious. Later the development of Assembly Language helped the programmers to some extent. The high level language FORTRAN was also developed for this generation of computers. This development brought the computers very close to man and made it a very popular machine. Some of the names of second generation computers are IBM series, UNIVAC III, CDC 1400 series, Honeywell etc.

Third Generation Computers (1964-75)

The development of integrated circuit was another milestone in the history of computer science. It was micro electronic technology, in which it was possible to integrate large number of circuit elements into very small surface area (less than 5 mm square) of silicon known as Chip. This generation was based on Integrated Circuits (IC) technology and the **computers that were designed with the use of integrated circuits were called third generation computers.**

These computers had better storage devices and improved input / output devices, such as Visual Display Unit (VDU), Magnetic Ink Character Reader (MICR) and high-speed line printers. These computers were 10,000 times faster than the first generation computers and arithmetic and logical operations could be performed in nano seconds (1 nano second=10^{-9} seconds). It was this time, around which major

Figure 1.16

advancement in the field of hardware as well as software took place. Many useful high-level languages were developed. These computers used operating system. The use of faster input and output devices enhanced the capabilities of these computers and made multi-programming possible, in which a number of programs could be executed simultaneously by a single processor. Some of the popular computers of this generation are IBM 360 series, 370 series, UNIVAC, HOG 9000 series etc. Some of them are still in use.
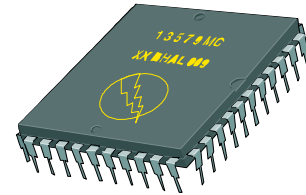
Fourth Generation Computers (1975 Onwards)

The development of microprocessor chip that contains entire central processing unit (CPU) on a single silicon chip led to the invention of fourth generation computers. The technology that was used in third generation computers in the form of Integrated Circuit (IC) was known as Small-Scale Integration (SSI). This IC contained about ten to twenty transistors on it. Later, the Medium Scale Integration (MSI) was developed, in which it was possible to assemble up to hundred transistors on a single chip.

Figure 1.17

After this, came the era of Large-Scale Integration (LSI) in which, it was possible to integrate 30,000 transistors on a single chip. Efforts were made and now the era of VLSI (Very Large Scale Integration) has come, in which millions of transistors can be assembled on single chip. **Current generation computers are fourth generation computers and are making use of VLSI chip.** This has made the size of current computer very small. Fourth generation of computers can be called microcomputer generation. The input/output devices used with fourth generation computers are quite advanced. These devices are optical readers, which can transfer the contents of CD within few microseconds to the computers. This generation's computers are compact, faster, and more reliable.

Fifth Generation Computers

Till fourth generation computers, the main stress was on hardware technology. Though these computers are faster, more accurate, reliable, smaller in size and very cheap, still they lack thinking power. **The fifth generation computers will have thinking power and capability to make decisions like human beings,** and may prove better than man in certain aspects. They will be more useful in the field of knowledge processing rather than in data processing.

Figure 1.18

In fact fifth generation computers are dreams of Japanese scientists. They have started work in this direction few years ago. The concept of Artificial Intelligence (AI) is being used in these computers. These computers will have Knowledge Information Processing System (KIPS) rather than the present Data/Logic Information Processing System. Japan has chosen the PROLOG (Programming in logic) language as its operating software and plans to have the final machine, which will talk with human beings, see and deliver pictures and hear man's natural language.
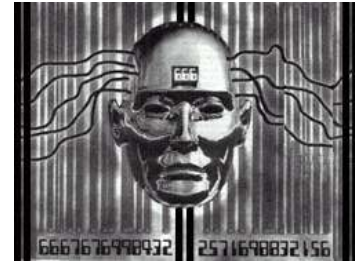
CLASSIFICATION OF COMPUTERS

You know that the device, which computes is called computer. For computation, computer takes some input, performs computation on it and gives result.

The type of input that computer accepts, decides its nature and capabilities and the type of computation that it will be able to perform. For example, some of the computers accept input in the form of signals. On the other hand, majority of computers take input in the form of digits. Some computers accept input in both the forms i.e. in the form of digits and signals. On the basis of input type, computers have been classified into following three categories:

1. Analog computers
2. Digital Computers
3. Hybrid computers

A brief description of all these types of computers is given below:

Analog Computers

Let's first understand what is signal. Signals can be defined as continuous flow of physical identity. Temperature, pressure, water level, speed, voltage, current etc. are few examples of signals.

Those computers, which operate upon signals (by accepting temperature, pressure, speed etc. as input) **are called analog computers.** Speedometer, thermometer, barometer, voltmeter, ammeter etc. are few examples of analog computers.

To understand the concept of analog computers, let's take the example of speedometer, which is used in scooters and cars. It makes use of cable. One end of the cable remains in contact with the wheel of the vehicle. The other end of the cable is inserted in the speedometer. When the wheel rotates, cable also rotates. Cable's rotation is thus passed to the internal assembly of the speedometer, which in turn rotates the needle on a calibrated scale. Thus when the vehicle moves, its speed gets displayed on the speedometer's scale.

The slide rule is hand-operated analog computer for doing arithmetic operations like multiplication, division etc.

Digital Computers

In computer terminology, alphabets, numbers, special characters etc. are called digits. Those computers, which accept digits (like name, age, e-mail address etc.) as input, are called digital computers. Computers that we see in offices, shops, hotels etc. are digital computers.

Hybrid Computers

Those computers, which accept both types of inputs i.e. signals and digits are called hybrid computers. For example, computers placed in ICU (Intensive Care Unit) are examples of hybrid computers. They accept heartbeats of the patient (signals) as input. They also accept instructions that need to be carried out (digits). Similarly computers placed in atomic reactors (taking radioactivity level and instructions as input) and mines (which take carbon monoxide level and instructions as input) are other examples of hybrid computers.

Note that in this book, we will mainly deal with digital computers. All the aspects, explained now onwards would mainly apply to digital computers unless stated otherwise.

Figure 1.19

TYPES OF COMPUTERS

Digital computers can be classified into various categories, on the basis of their sizes. When we say, size of the computer, it refers to multiple factors like, size of the memory, number of terminals that can be connected to the computer, storage capacity of the hard disk, type of processor used in the computer etc. Digital computers are generally classified into following categories:

1.   Microcomputers
2.   Mini computers
3.   Mainframe computers
4.   Supercomputers

Micro Computers

Microcomputer is the smallest category of computers, in which single microchip is used for two basic units i.e. ALU and Control Unit. This microchip is often referred to as microprocessor. Microcomputers are further classified into following categories:

1.   Personal computers
2.   Laptop computers
3.   Tablet PC
4.   Personal Digital Assistant (PDA)

Personal Computers (PC)

Figure 1.20

Computers that you commonly see these days are examples of Personal Computers. In short, they are called PC. Their outward appearance is shown in figure 1.20. They mainly comprise of four units i.e. CPU box called chaises, keyboard, VDU and mouse. Only one person can work on them at a time, so they are called single user computer. Originally they were designed and manufactured by IBM. Later, as they became popular, other manufacturers also started manufacturing similar type of computers called IBM clones.

Laptop Computers

Figure 1.21

Laptop computers also fall into the category of microcomputers. They possess same capabilities and resources that of Personal Computers. A laptop is shown in figure 1.21.

In their outward appearance, Laptop computers look like a briefcase. Upper panel of the briefcase comprises of LCD screen. Lower panel contains keyboard and mouse arrangement. Other components and circuitry remain packed inside the briefcase. They are deliberately designed to be light in weight. They run on chargeable battery, which resides inside. Due to their size, weight and

independence from power (for two to three hours) people carry them while traveling in car, train or airplane and work on them.

Tablet PCs

Tablet PC is the latest development in the field of computers. Its physical appearance is illustrated in figure 1.22. Note that it looks like laptop computer with many more enhancements and additional facilities packed, within same space.

Figure 1.22

Display system of Tablet PC, vertically rotates, by 180^0. When rotated, it starts accepting input through a special light pen, called light pen. Whatever is written on Tablet PC's screen, with the pen, in natural handwriting, is taken as input. Thus writers need not write their articles on paper and then give it to typists to get its formatted copy. They can directly write the text on Tablet PC's screen, using light pen. Tablet PC will recognize their handwriting and save the document in predefined format, in desired font, as if typist typed it on computer. Similarly artists can now draw figures, directly on Tablet PC's screen and color them too. Light pens also have provision for removing written text or drawing lines, as if natural eraser was being used for making corrections.

Some of the Tablet PCs also accept voice input, through microphone. Whatever is spoken in front of them is converted into text file.

Personal Digital Assistants (PDA)

Personal Digital Assistants are very small computers that fit within a palm. A PDA is illustrated in figure 1.23. They are often of the size of scientific calculator. This is the reason, why they are also called Palmtop computers. They are mostly used for storing addresses, telephone numbers, maintaining personal appointments etc. They can also be connected to higher range computers either through cable or wireless link, for the exchange of data and information.

Figure 1.23

Minicomputers

Minicomputers are relatively larger and faster computers. Apart from single user environment, they also support multi user environment. They are generally used for automating those applications, which are large in size, require fast processing capabilities and demand for resource sharing among multiple users. Main characteristics of minicomputers are described below.

1. They are built, using high performance and high capability processors.
2. Memory size in such type of computers is generally very large.
3. They support multiple terminals, which may range from 2 to 16.

4. Large capacity disks are used in multiple numbers so that the data and programs of all the users could be put on-line.
5. They provide facility to connect multiple printers.
6. They possess the capability of performing computer network related major operations.

Mainframes

Mainframes fall into next higher category of computers. Their internal architecture and circuitry remains different from minicomputers. They use specially designed proprietary circuits instead of just single microprocessor as their CPU. Their circuitry promotes higher connectivity, faster throughputs and large data processing capabilities.

Due to proprietary circuitry, mainframes become quite big in size and provide facility for connecting minicomputers and microcomputers with them. Few characteristics of mainframes are listed below.

1. They possess the capability of addressing larger memory sizes than that of minicomputers.
2. They also support larger capacity disks like optical disks etc.
3. Their terminal connectivity can go as high as 256 or beyond.
4. They possess large number of application libraries that provide great help to developers in developing useful applications.

DEC 20, IBM 370 etc. are the examples of few mainframes. IBM (USA) is the largest manufacturer of Mainframe computers.

Figure 1.24

Supercomputers

Supercomputer is the largest category of computers. They use multiple CPUs for processing the data and executing the instructions. While performing a task through Supercomputer, the complete task gets divided into multiple independent tasks. Each CPU takes up individual task and completes it in parallel. This methodology of processing is called parallel processing.

Due to parallel processing, Supercomputers become capable of processing large volumes of data at very fast speed. They process multi million to few trillion commands per second. Applications like weather forecasting, nuclear weapon design, projection system modeling, aero modeling etc., which require

Figure 1.25

tremendous processing capabilities, can be very well executed on Supercomputers. CRAY, XMP 24 and NEC 500 are few examples of Supercomputers.

PARTS OF A COMPUTER SYSTEM

Computer and computer system are two different things. The word computer refers to that bare electronic device, which possesses computing power, using which wide variety of operations are performed, while computer system refers to group of items, which put together make computerization of an application possible. Computer system comprises of following five major parts:

1. Hardware
2. Software
3. Firmware
4. Data
5. User

A detailed description of all these parts of computer system is given below:

Hardware

The physical part of computer system is referred to as hardware. All electronic and mechanical items that constitute computer system fall into the category of hardware. For example, keyboard, mouse, monitor, printer, processor etc. are hardware. Power and capabilities of hardware, directly govern the power of computer system. For example, weaker is hardware of PC in comparison to supercomputer so higher-end applications like aero modeling, weather forecasting etc. cannot be performed on it. On the other hand, all these applications become possible on supercomputer hardware because they are built using most powerful electronics.

Software

Computer hardware is basically dumb equipment. Although it possesses computing power but it cannot compute on its own. It requires step-by-step instructions for computing. Without instructions it cannot compute.

Any instruction, which either makes hardware perform a task or ready for performing the task, is called software. For example, just by switching on the computer and pressing the keys of the keyboard, computer will not accept the data. Prior to that, it will require set of instructions, which would gear up the hardware internally, to accept the data. Thus all these instructions will be called software. Similarly after activating the computer, another set of instructions could be given to:

❑ Accept student's data
❑ Process the data
❑ Generate result sheet for each student and prepare merit list.

This set of instruction is also software.

Now just compare the results achieved by two different sets of instructions, mentioned above. One set of instruction performs few functions, internally within the computer and

another set of instruction performs noticeable actions externally. (like printing the mark sheet, merit list etc.).

Thus based upon the tasks performed by the software, softwares are broadly classified into following two categories:

- ❑ System Software
- ❑ Application Software

System Software

All those instructions, which computer uses either for its activation or internal resource management are called system software. For example, software that would transfer the data/instructions from keyboard to computer's memory will be system software. Similarly the software that would make the processor run and do the calculations or print the result of calculations on printer/monitor will also fall into the category of system software. Following are the names of few system softwares, which are essentially required for normal functioning of computer system.

Operating System : Operating system is the first and foremost system software that is required for any computer system to become operational. For any computer system to become operational, it activates all its devices, components and resources and makes them ready for work.

It performs all internal management functions and ensures systematic functioning of computer.

Commands : All those instructions, using which, day-to-day housekeeping tasks are performed on computer, also fall into the category of system software. For example, commands for storing the data in file, viewing the contents stored in a file, making duplicate copy of a file, renaming a file etc. are all system software.

Utilities : All those softwares, which safeguard the computer and its resources from hazards or ensure its proper functioning or build an efficient working environment are called utilities. Utilities are basically system software. For example, data compression utilities, virus protection utilities, disk fragmentation utilities etc. are system software.

Device Drivers : That software, which is written with the objective of making a device functional when it is connected to the computer, is called device driver. For example, device driver for web camera, device driver for light pen, device driver for printer etc. are example of system software.

Application Software

Those instructions, which are given to the computer for automating a manual task, are called application software. For example, instructions for adding two matrices, finding sum of given Geometric Progression (GP) series, calculating income tax for all the employees of an organization, booking air tickets etc. are examples of applications software.

Application software is either developed using special packages or special computer languages that are developed for this purpose.

Special software development packages like MS-Office, CorelDraw, Photoshop, Flash, 3-D Studio Max etc. are the packages that are developed to automate specific type of task. For example, MS-Office package has been developed for automating office activities (like writing letters, preparing reports and charts, making presentations, handling queries, etc.) Similarly CorelDraw is a package, using which desk top publishing work is performed on computer. Flash is used for creating animations on computer. Photoshop is used for photo editing tasks and 3-D studio Max is used for crating presentations.

There are many activities, which either don't fall within the scope of ready-made software or for such activities custom-built software need to be developed. Custom-built software is developed, using computer languages like Visual Basic, C++, Java etc. For example, there may not be any ready-made package available to computerize pay management activities of an organization. In this case, a custom-built pay roll package will have to be developed, for the organization. This package and many other of this type fall into the category of application software.

Firmware

The software that is built into hardware is called firmware. For example, in computer system, few special instructions called bootstrap instructions (software) are written (with the help of special devices) within an electronic chip (hardware) called Read Only Memory (ROM) and this chip is integrated with the electronics of the computer system. This software basically reads the operating system, loads it into computer's memory and makes the hardware functional. Note that bootstrap program is an example of firmware as it always resides within electronic chip.

Data

Raw facts and figures are termed as data. For example, roll numbers, name, address and marks of all the students studying in a class is data.

Data always has some surprise element (hidden facts) associated with it. Often (specially when data volume is large) this surprise element remains unnoticeable to the person who views the data. Thus, data carries no meaning for him.

Data works as raw material for computer system. Computer system processes the data and brings out the hidden surprise element in it. For example, after processing students' data a merit list may be prepared, showing the roll number, names and marks of 10 top rankers. This list is surprise element, which has brought out a hidden fact that these students are outstanding. Note that the details of these students were already there in the data but were unnoticeable to the viewer. Processing has brought them out and focused viewer's attention on them.

Note that surprise element helps in decision-making. For example, say three students have to be awarded scholarship of Rs. 25,000, Rs. 15,000 and Rs. 5,000. In this situation, surprise element (merit list in this examples) will be helpful in deciding, who should be awarded what amount. It is quite obvious that in the absence of surprise element, the chances were bright that the decision would have gone wrong.

Information

In computer terminology, processed data is called information and information is always useful for decision making. Thus, it can be said that computer processes the data and converts it into information for decision making.

User

Persons who make use of computers are called users. No computer system is complete, without user. From beginning to the end of automation process, they require user intervention. Users can be broadly classified into following two categories:

1. Programmers
2. End users

Programmers are the users, who use computers to write programs. Those programmers who write system programs (system software) are called system programmers and those who develop application programs are called application programmers.

End users are the persons, who make use of computer hardware, system software and application software for some specific purpose, for which the application software was designed. For example, the railway reservation clerks, sitting at reservation counter and doing reservations for passengers are end users of railway reservation package. Similarly there would be end users of other application packages.

COMPUTER PROGRAM

Although wide variety of tasks can be performed through computer but computer being dumb device, doesn't perform anything on its own. May they be its internal operations or user's task; it requires step-by-step instructions for carrying them out.

Without instructions computer doesn't work. Set of instructions that are given to the computer for performing a specific task is called program or computer program. For example, set of 10 instructions give to the computer for identifying and printing the largest number among 20 given numbers will be a program. Similarly all those instructions, using which berths are reserved for passengers in trains will be another program. Likewise you have programs for every task that computer does. Without program computer is useless.

Programs are written in computer languages. For example, C, C++, Visual Basic, Java etc. are few popular computer languages that are commonly used for writing programs.

Those programs that are written for carrying out computer's internal tasks like transferring the data from keyboard to memory, from memory to processor or to monitor etc. are called system programs.

Programs that are written for computerizing manual activities like finding roots of quadratic equations, preparing invoice, railway reservation, hospital management etc. are called application programs.

If the task to be automated is larger, more than one program may be required for automating the complete activity. Set of all those programs is often referred to as package

or software package. In other words, it can be said that software package is a group of related programs that put together perform a given task that is generally big in nature. For example, railway reservation package, hospital management package, payroll package etc.

SUMMARY

All those devices that compute are called computer. Computers have a long history. They have traveled a long distance from primitiveness to sophistication. Abacus is the first manmade computing device that came into existence. After Abacus many devices like Napier's Bones, Slide rule, Pascal' Calculator, Leibniz's Calculator, Charles Babbage Difference Engine, Babbage's Analytical Engine, Hollerith Machine, Mark-1, Electronic Numerical Integrator and Computer (ENIAC), Electronic Discreet Variable Automatic Computer (EDVAC) came into existence one by one. Lately came the era of modern computers. Each computer that came into existence was smaller in size but faster in speed than its predecessor.

Computers of specific electronic era are often referred to as a generation. All together four generations of computer have come into existence. First generation computers made using vacuum tubes. Second generation computer made use of transistors. Computers that were designed with the use of integrated circuits were called third generation computers. Current generation computers are fourth generation computers and are making use of VLSI chip. Computers that would have thinking power will come in future and are often referred to as fifth generation computers.

On the basis of input that computers accept, they have been classified into three categories:

  1. *Analog computers*
  2. *Digital Computers*
  3. *Hybrid computers*

Those computers, which take signals as input, are called analog computers. Those computers, which accept digits as input, are called digital computers. Those computers, which accept both types of inputs i.e. signals and digits are called hybrid computers.

Computers that we generally see in offices, schools, colleges etc. are digital computers. Digital computers have been classified into following categories:

  1. *Microcomputers*
  2. *Mini computers*
  3. *Mainframe computers*
  4. *Supercomputers*

Microcomputer is the smallest category of computers and supercomputer is the largest.

Physical part of the computer that can be seen or touched is often referred to as hardware. Hardware doesn't function on its own. It requires instructions to work. All those

instructions that make the hardware work are called software. Softwares are broadly classified into following two categories:

❑ *System Software*
❑ *Application Software*

All those instructions, which computer uses either for its activation or internal resource management are called system software.

Those instructions, which are given to the computer for automating a manual task, are called application software.

A set of instructions, prepared for computer to perform a given task is called program.

Computer is mainly used for data processing. Raw facts and figures are called data. Once data is processed, it is called information.

EXERCISES   CHAPTER 1

Short Type Questions

A. Select most appropriate answers for following questions:

1. What do you call that calculating device, which makes use of beads for calculations?
   (a) Napier's Bones   (b) Slide rule
   (c) Pascal's adding machine (d) Abacus

2. Which of the following computing device was invented by the same person, who discovered logarithmic tables?
   (a) Napier's Bones   (b) Slide rule
   (c) Pascal's adding machine (d) Abacus

3. Name the electronic component, which was used in first generation computers.
   (a) Transistor   (b) Vacuum tube
   (c) PCB   (d) IC

4. Which of the following device was the first device to make use of punched codes?
   (a) Abacus   (b) Jacquard's loom
   (c) Second generation computers (d) Modern computers

5. Which of the following computer accepts signal and digits as input?
   (a) Analog computers   (b) Digital computers
   (c) General computers   (d) Hybrid computers

6. What is program?
   (a) Computer language   (b) Set of instructions for computer
   (c) Computer planning   (d) Physical part of computer

7. Which of the following is the largest category of computer?
   (a) Supercomputer   (b) Microcomputers
   (c) Minicomputers   (d) Mainframes

8. Which of the following is the largest category of computer?
   (a) Supercomputers   (b) Microcomputers
   (c) Minicomputers   (d) Mainframes

9. What do you call the physical part of computer?
   (a) Software   (b)Program
   (c) Hardware   (d) Package

10. What is processed data called?
    (a) Program   (b) Information
    (c) Signal   (d) Software

B. Fill in the blanks:

11. .... generation computers made use of VLSI chips.

12. Fifth generation computers will have..power.

13. Slide rule is an example of..computer.

14. Computers that we use in computer lab are....................................computers.

15. Computers that are used in mines, ICUs etc. are examples of....................computer.

16. Computers that take signal as input are classified as .... computers.

17. Those computers, which accept signals and instructions both, are called .... computers.

18. Raw facts and figures are called ....

19. All those instructions, using which computer performs its internal tasks are called ....

20. Those computers, which make use of microprocessors to process the data are called ....computers.

C. State, true or false for following statements:

21. Abacus is first generation computer.

22. Pascal's adding machine could perform multiplication and division also.

23. ENIAC computer made use of vacuum tubes.

24. Speedometer of a vehicle is an example of digital computer.

25. Integrated circuits were first introduced in third generation computers.

26. ENIAC computer came after EDVAC computer.

27. Vacuum tubes came into existence before transistor.

28. Fourth generation computers are smaller in size and faster than third generation computers.

29. Processed data is called Information.
30. Physical part of the computer that can be seen or touched is called software.
31. Collection of computer instructions that put together automate a given task are called program.
32. PDA is a type of computer.
33. Mainframe computers are bigger than microcomputers and smaller than supercomputers.
34. Mainframe is the fastest among all types of computers available these days.
35. Weather forecasting type of applications can only be done on supercomputers.

D. Answer the following questions in short:

36. Which computing device was invented by Blaise Pascal?
37. Modern computers belong to which generation?
38. Name the mathematician who invented the calculating device called Napier's Bones.
39. Name any two types of signals that could be given as input to analog computers.
40. Which type of input is given to digital computers?
41. Which type of input is given to hybrid computers?
42. Which word will characterize fifth generation computer?
43. Which calculating machine made use of punched cards and which was the non-calculating device, from which the concept of punched card was taken?
44. Give an example of digital computer.
45. What is data?
46. What is information?
47. What is computer hardware?
48. What is software?
49. What is system software?
50. What is computer program?
51. What is package?
52. Name any two computer languages.
53. Name any three computers that fall into the category of microcomputers?
54. Which computer can be used while traveling in train or airplane?
55. Write the full form of PDA.

Detailed Answer Type Questions

E. Answer the following questions in detail:

56. Describe any five historic calculating devices, in the order, in which they came into existence.

57. What is ENIAC? Describe its characteristics.

58. What is vacuum tube? What is its relationship with computers?

59. How were second-generation computers different from third generation computers?

60. Write a short note on fifth generation computer.

61. What are analog computers? Give at least two examples of analog computers.

62. What are digital computers? Give an example of digital computer.

63. How are hybrid computers different from analog and digital computers? Give example of hybrid computers.

64. Write a short note on generations of computer.

65. Write basic characteristic of laptop computers.

66. Differentiate between system software and application software.

67. Differentiate between hardware and software.

68. Differentiate between data and information.

69. In what way modern computers are different from olden computers?

70. In what way supercomputers are different from supercomputers?

71. Define the term firmware. What is its role in computer?

72. What is device deriver? Explain its role in computer?

****

Computer Application Theory

CHAPTER 2

Computer Organization

Computer is electronic equipment. It is mainly used for automating manual tasks. Using computer you can perform tasks quickly, effectively and in error free manner. Be it any organization, office, factory or institution, you can find people making use of computer there. In offices, computers are used for preparing letters, documents and reports. In hotels, computers are used for advance booking of rooms, preparing bills and providing enquiry services. In railways, computers are used for rail reservation, printing of tickets and preparation of reservation charts. Doctors use computers for diagnosing illness and treatment of deceases. Architects use them for map designing and city planning. In meteorology department, computers are used for weather forecasting. In short you can say that there is hardly any sphere of life left now, in which computers are not being used. What computer is, what are its main units, how does it function are the issues, which are described in this chapter.

BASIC COMPONENTS OF DIGITAL COMPUTER

As you know, computer is an electronic device, it comprises of many units. These units work in coordination with each other to perform the given task. Block diagram of computer is shown in figure 2.1.

Refer this figure and note that computer comprises of following units:

1. Input Unit
2. Output Unit

Memory

ROM (Read Only Memory)	
RAM (Random Access Memory)	

Processor

Control Unit

ALU

Input Unit

Output Unit

Secondary Storage Unit
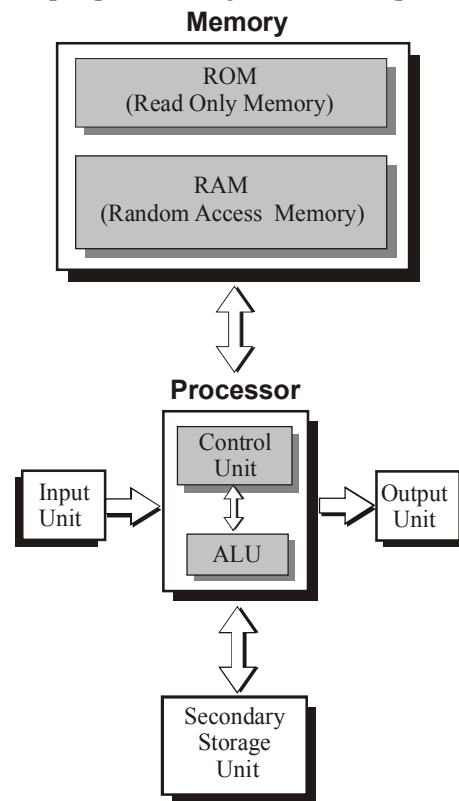
Figure 2.1

3. Input/Output Unit
4. Central Processing Unit
   (a) Memory Unit
   (b) ALU
   (c) Control Unit

Physically these units exist in the form of electronic devices in computer. Each unit performs its own function, in co-ordination with other devices and thus computer performs the given task. What is the role of each unit and in what form do they physically exist, is explained below.

INPUT UNITS

The role of input unit in computer is to provide means for supplying data or instructions to the computer. In other words, you can say that what you supply to the computer for processing is supplied through input unit. For example, if you wish to calculate simple interest on Rs. 10,000, @ 7% for 5 years then the data 10,000, 7, 5% etc. and the instructions for calculating the simple interest will have to be given to the computer, through input unit.

All those devices, using which input is provided to the computer are termed as input units. Following are few commonly used input units that can be found attached with almost every computer.

Keyboard

Keyboard consists of many keys. Keys have alphabets, numbers, characters or words written on them. Keyboard is illustrated in figure 2.2.

When keyboard is connected to the computer, a blinking sign (| or −) appears on the monitor. This sign is called cursor. When you press an alphabet or number key, the character written on the key gets typed at current cursor position and the cursor moves forward.

Figure 2.2

Keys

Keys of the keyboard are broadly classified into following categories:
- ❑ Alphabet keys
- ❑ Number keys
- ❑ Special character keys
- ❑ Function keys
- ❑ Cursor keys
- ❑ Action keys

Alphabet Keys

Alphabet keys have alphabets, from A to Z, written on them. By pressing these keys, you can type alphabets, words, sentences etc. in lower case. For example, when you press 'A' key, 'a' gets typed. To type the alphabet in upper case, you need to press Shift key along with the alphabet key. For example, if you press 'A' key along with Shift key, letter 'A' gets typed.

Number Keys

Number keys have digits, from 0 to 9, written on them. These keys are used for typing the numbers. Note that each number key also has a special character written just above the number. To type this character, you will have to press the number key along with the Shift key. For example, number 5 key has % sign marked on it. When you press number 5 key, 5 will get typed. If you pres the same key, along with Shift key % sign will get typed.

Special Character Keys

Few keys of the keyboard have special characters like semicolon (;), comma (,), dot (.) etc. marked on them. Such keys are called special character keys. When you press special character key, character marked on it gets typed at current cursor position.

Function Keys

There are 12 function keys present on the keyboard. They are named as F1, F2, F3 …..F12. When you press these keys they perform special functions.

Cursor Keys

Four cursor keys are there on the keyboard. They are marked with arrows on them, pointing in four different directions. Using cursor keys, you can move the cursor from one place to another.

Action Keys

Keyboard has many action keys. When you press an action key, a special event takes place. Most commonly used action keys of the keyboard are described below.

Caps Lock Key

When you press this key, capital lock becomes on. When you press an alphabet key, while capital lock is on, the letter written on it gets typed in upper case.

Shift Key

Shift key is always pressed along with other keys. When you press this key along with number key then the symbol written on upper part of the key gets typed. When you press Shift key along with alphabet key then the alphabet gets typed in upper case.

Enter Key

Enter key is used to start a new line. When you press this key; cursor comes to the next line. Whatever you type now, gets typed in the next line.

Space Bar

This key is used to put blank spaces between the two characters.

DEL Key

This key is used to rub a character from current cursor position.

Backspace Key

This key removes one character from the left side of the cursor.

Insert Key

This key is used to insert characters in between the two characters, which have already been typed.

Page Keys

There are two page keys on the keyboard, named as PgDn (i.e. Page Down) and PgUp (i.e. Page Up). When you press PgUp key, previous page gets displayed on the screen. When you press PgDn key, next page gets displayed on the screen.

Tab Key

This key is used for making the cursor jump in forward direction, by many places.

ESC Key

This key is called Escape key. Currently on-going activity gets cancelled when this key is pressed.

Mouse

Mouse is an input device. It is shown in figure 2.3. It looks like a real mouse with few buttons placed on its back. When mouse is connected to the computer, an arrow sign appears on the monitor screen. This sign is called Mouse Pointer.

Mouse Pointer

Figure 2.3

When you move the mouse on plane surface, mouse pointer also moves in the same direction. Thus by moving the mouse, you can make the mouse pointer point to anything present on the screen. After pointing the mouse on any desired object, following actions can be performed:

Clicking The Mouse

Pressing the left button of the mouse and releasing it is called clicking the mouse.

Double Clicking The Mouse

Pressing the left button of the mouse twice, in quick succession, is called double clicking the mouse.

Dragging The Mouse

Moving the mouse, with its left button pressed is called dragging the mouse.

Dropping

Moving the finger away from the mouse after dragging it is called dropping.

CD-ROM Drive

CD is acronym for Compact Disk. It works as a medium for storing data or instructions. It looks like circular plastic disk. Huge amount of data can be stored on CD. For example, single CD can hold personal data of all the students studying in a college.

CD-ROM drive is an input unit that reads data from CD. As the name indicates, CD-ROM (Compact Disk Read Only Memory) can only read the data from CD, it cannot write on it. CD and CD-ROM drive are shown in figure 2.4.

Figure 2.4.

Other Input Units Of Computer

Microphone, Barcode Reader, Magnetic Ink Character Reader (MICR), Joystick, Touchpad, T Mouse, Light Pen, Touch Screen, Scanner etc. are other input devices.

OUTPUT UNIT

The role of output unit is to show the result of processing. In other words, you can say that computer displays all the results on its output unit. For example, if you are calculating simple interest on computer, it will display the interest amount on its output unit. Following are few commonly used output units of computer.

VDU

VDU is acronym for Visual Display Unit. It looks like portable TV. VDU is shown in figure 2.5. It is primarily used for following two purposes:

- ❑ To display the contents that are being typed through keyboard.
- ❑ To display the result of processing (output).

Figure 2.5

Printer

Printer is an output device. It prints the output on paper. Different types of printers print differently. Their quality and speed of printing differ from each other. Following are different types of printers, which are being commonly used these days:

1. Dot Matrix Printer
2. Inkjet Printer
3. Laser Printer

Dot Matrix Printers

These printers are very versatile printers and drive their name "Dot Matrix" from the fact that they print the characters making dots. Pins of the printer print these dots so close to each other that the gap between them is hardly visible. Viewer gets an impression of full continuity. These printers are versatile printers and are capable of printing not only text, but up to some extent graphics also. They are relatively fast printers and their speed varies from 300 Character Per Second (CPS) to 600 CPS.

Inkjet Printers

For printing the characters and drawings, inkjet printers make use of colored inks. They use Cyan, Magenta, Yellow and Black inks. Using these four basic colors, inkjet printers generate all other colors. These printers are very popular due to their high quality and low cost.

Laser Printers

These are high quality, high speed and high cost printers. In such type of printers, printing is done, using laser beam and black magnetic powder, called Toner. Speed of these printers can range from 10 pages per minute to about 200 pages per minute. They cost much higher than dot matrix and inkjet printers. All the three types of printer are shown in figure 2.6.

Dot Matrix Printer   **Inkjet Printer**   **Laser Printer**

Figure 2.6

Other Input Units Of Computer

Plotter, Web Camera, Digital Camera, Speakers, etc. are few other output devices.

INPUT/OUTPUT UNITS

As you know, input units provide means for supplying data or instructions to the computer, while output units provide mechanism for displaying the results. While making use of them data, instructions or results involved in this process do not get retained permanently in computer. They get erased when computer is switched off. If you need them again, process has to be repeated. On contrary to this, Input/Output units serve the purpose of both i.e. input unit and output unit as well. They retain the data/result permanently. Whenever required, the data, instructions or results can be written on them. Later, as and when required, they can be read from there.

All such units, which provide means for storing the data, instructions or results permanently, are called input/output units. Following types of Input/Output units are commonly used in computer.

Floppy Drive

Floppy drive is an Input/Output unit. It is basically an assembly, in which you put the floppy, close its door and then perform read / write operations on the floppy. For analogy, you can think of tape recorder's cassette housing assembly, in which you put the cassette, close the door and then perform read / write operations on the cassette. Similarly you either write the data on the floppy or read the data from the floppy. Whatever you write on floppy, it gets permanently stored there, until you delete it yourself or mishandle the floppy. Floppy and floppy drive are shown in figure 2.7.

Floppy　　　　　　　**Floppy Drive**

(a)　　　　　　　**(b)**
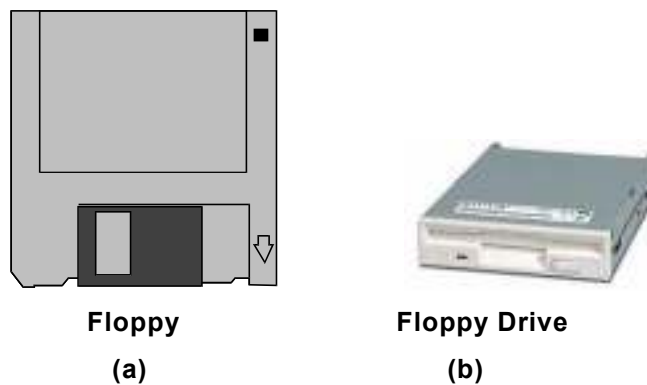
Figure 2.7

Floppy is basically a data storage medium, on which you record the data or programs to read them later. Floppy consists of flexible plastic coated with magnetic material iron oxide. This plastic is enclosed in a thick black gasket cover, which protects it from heat, dust, sun etc. Most commonly used floppies are of 3 ½" size.

Hard Disk

Hard disk is another unit, which stores the data permanently in computer. Externally it looks like a box and remains fixed within computer chassis. Its internal composition is shown in figure 2.8.

Refer this figure and note that hard disk consists of multiple dish like units, on which the data is stored. These dishes are called platters. Each platter has a corresponding read-write head.

Read-write heads write the data or instructions on the platters. Thus they get permanently stored there.

Note that floppy and hard disk both are used for storing data but the capacity of the hard disk is generally many times more than that of a floppy. Floppy is a removable storage medium while hard disk is a fixed medium.

Figure 2.8

CD-Writer

CD writer is another Input/Output device, which stores data, instructions, results etc. permanently on medium called CD-R and CD-R/W.
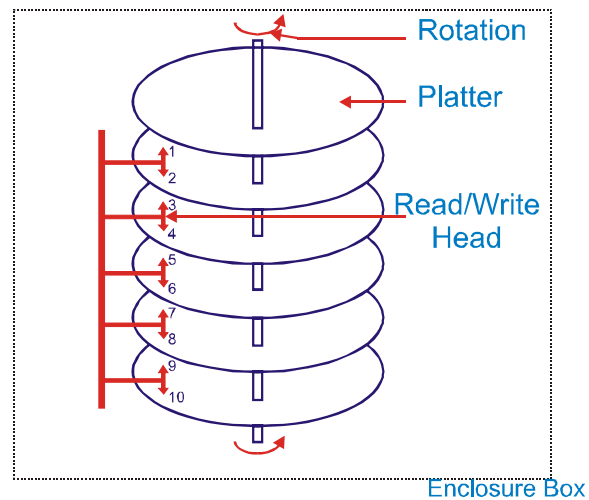
CD-R

CD-R is acronym for Compact- Disk Readable. It resembles CD, on which data can be written. Data is written on CD-R through a device called CD Writer. CD-R looks like CD but its internal composition remains different. But note that data can only be written once on CD-R but not again and again.

CD-R/W

CD-R/W is acronym for Compact Disk Re-Writeable. It looks similar to CD-R but data can be written multiple times on it. If you wish, you could write data on it, read data from it and erase the data as many times as required. CD-Writer and CD-R are shown in figure 2.9.

CD-R   **CD-R/W**   **CD-Writer**
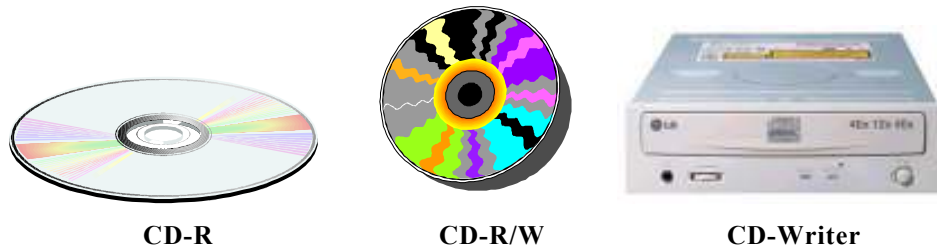
Figure 2.9

Magnetic Tape Drive

Magnetic tape drive is another input/output unit, which is used for storing the data permanently. It accesses the data sequentially. Using this unit, data is recorded on magnetic tapes. Magnetic tape drive in its appearance looks like older spool based tape records. Its block diagram is illustrated in figure 2.10.

In magnetic tape drive, magnetic tape from feeder spool passes below the Read/Write head and remains tied in other spool.

When magnetic tape drive is switched on and instructions for writing the data are given, the spool on the right hand side rotates. Thus the tape moves forward. Read/Write head records the data on moving tape.
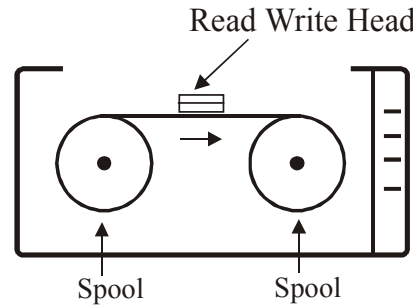
Figure 2.10

To record the data properly on tape, it is necessary that magnetic tape should always remain in stretched position. While the spools move or stop, tape should not get loose. If it so happens, data will not get recorded properly and will produce garbage, when read. Generally two techniques are used to keep the tape stretched. They are as follows:

1. Tension arm
2. Vacuum column.

In tension arm technique, tape is kept stretched, with the help of mechanical arms while in vacuum column technique tape is kept stretched by creating vacuum. Those tape drives, which use tension arm technique, are called tension arm tape drives. Those tape drives, which use vacuum technique, are called vacuum column tape drives.

Magnetic Tape

Magnetic tape is a medium to record the data. Generally it is 12.5 mm. to 25 mm wide and 500 meters to 1200 meters in length. It is made of magnetic material coated plastic. When the tape passes below read/write head, it creates magnetic waves and writes data on the tape. Note that data does not get continuously written on the tape. It gets recorded in blocks. There remains a gap (blank space) between the two blocks. This block is called Inter Block Gap or IBG in short. The way data gets stored on the tape, is illustrated in figure 2.11.
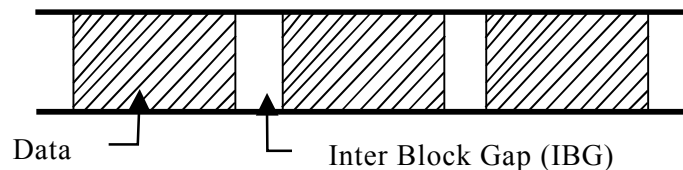
Figure 2.11

Magnetic Cartridge Tape Drive

Like magnetic tape drive, magnetic cartridge tape drive is also an Input/Output unit, which records the data on tape. Cartridge tape drives are much smaller in size than magnetic tape drives. They do not store the data on spool tapes. They store it on cartridge tapes. Cartridge tape resembles small video tape that is used in handy cams. The shape of cartridge tape is shown in figure 2.12.
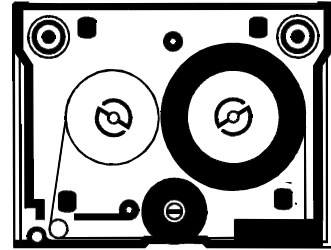
Figure 2.12

CENTRAL PROCESSING UNIT

Refer figure 2.1 and note that three units viz. Memory, ALU and Control Unit put together are referred to as Central Processing Unit or CPU in short. Role of each unit is explained below.

Memory

Memory holds data, instruction or results temporarily. For example, when you give instructions to the computer to compute simple interest on Rs. 10,000, @ 7% for 3 years, this data and instructions come into computer from any of the input or Input/output devices and get stored in memory. Similarly result (simple interest in this example) also gets stored in memory. In other words, you can say that the unit, which holds data, instructions or results in it, is called memory.

Types Of Memory

Depending upon the nature and behavior of memory, computer memories could be categorized into following categories:

1. Primary Memory
2. Cache Memory

Characteristic behavior of each type of memory is described below.

Primary Memory

That memory, which is utilized by the computer for its internal functioning, is called primary memory. Since it plays an important role in internal functioning of computer hence it is often referred to as internal memory. Primary memory is further categorized into two categories:

1. Read Only Memory (ROM)
2. Random Access Memory (RAM)

Read Only Memory (ROM)

This memory by its nature is quite special. Computer cannot write data in it. Using special devices, such as ROM programmer, instructions are written in it. Once instructions are written in it, it is put inside the computer. As and when required, computer reads instructions from it. Since data can only be read from it hence it is called Read Only

Memory or ROM in short. ROM physically exists in the form of blank electronic chip, in which programs or data are written, using special devices. Those ROMs, in which data once written, cannot be erased by any means are called Programmable Read Only Memory or PROM in short. Other type of ROM, in which data is written or erased, using ultraviolet rays is called Erasable Programmable Read Only Memory or EPROM in short.

Random Access Memory

In short, Random Access Memory is called RAM. It differs from ROM in nature. It provides both, reading and writing facilities. As and when required, computer writes data or instructions in it and reads them whenever necessary. This is the reason why they are also called Read/Write memory.

Note that whatever data or instructions are given to the computer for processing, computer writes them in RAM. As and when required, it reads them from there and processes them to generate the result. Computer first writes all the results in RAM and then whenever necessary, it transfers them to output unit.

The data written in Random Access Memory remains there till the time computer power is on. As soon as the power goes off, data written in RAM gets erased.
This is the reason why they are also called Temporary memory.

Cache Memory

In cache memory reading and writing operations take place at very fast speed but it costs very high. When it is introduced into computer, it increases its speed and cost also. For best cost-performance ratio, sufficient amount of cache memory (less then the size of RAM) is introduced in the computer, in between the processor and Random Access Memory, as shown in figure 2.13.

Figure 2.13

First time, when computer requires data/instructions/results from RAM, it reads them from there. But at the same time, many more of them are read and put in cache memory. Next time, whenever computer requires something from RAM, it reads it from cache memory. Since the speed of cache memory is faster than RAM hence reading is done in much shorter time. When computer doesn't get the required item in cache memory, it goes back to RAM and reads it from there along with many more items. The whole mechanism of reading and writing, in computers, is implemented in such a way that most of the time required items are found in cache memory. On the other hand, if computer has to write the data in RAM, it writes it in cache memory, from where it is transferred to RAM.

Thus cache memory improves the speed of computer. In short, it can be said that the memory, which is introduced in the computer with objective of increasing its speed, is called cache memory.
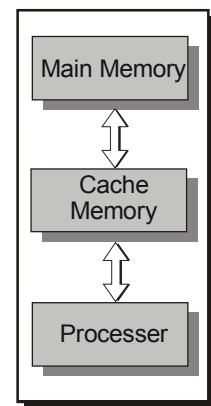
Arithmetic & Logic Unit - ALU

ALU is acronym for Arithmetic and Logic Unit. It performs arithmetic and logical calculations in computer. Recall that calculations like, addition, subtraction, multiplication

division etc. fall into the category of arithmetic calculations. Operations like a>b, c>=d etc. are logical operations. In computer terminology, the activity of performing arithmetic and logical calculations is called processing. In other words it can be said that in computer ALU performs data processing.

Control Unit

While computer functions, data moves from one unit to another unit. For example, when you give input to computer, data and instructions move from input unit to memory. When data is processed, it moves from memory to ALU. Similarly when processing is over, results move from ALU to memory and memory to output unit. Now the question is which part of computer organizes data movement within the computer? Well, Control Unit is the main unit, which performs traffic police like task. It ensures movement of right data from right source, to right destination at right time so that all the units of computer perform their functions in coordination with each other.

CHARACTERISTICS OF COMPUTER

Following are the characteristics of computer:

1. Computers are basically dumb devices. They cannot perform any function on their own. For doing anything on computer, you have to give instructions to them. Generally these instructions are written in computer language and are given from the keyboard.

2. Computer performs the tasks according to the instructions provided by the user. In other words, you can say that the correctness of output depends upon the correctness of the data and the instructions provided by the user. For example, if you add two numbers 70 and 30, the result could be 40 in case you have given wrong instruction i.e. subtraction instead of addition.

3. The speed, with which a computer performs a task is much faster than manual speed. As a result of which, computers are widely used for performing those tasks, in which speed is of prime importance.

4. Computer can perform a task with the same speed for several days without getting tired. This is not possible in case of manual activities. Human beings get tired after sometime and the chances of making mistakes start getting high as the time passes by. So you can say that computers are capable of performing error free tasks efficiently for the duration, which is beyond human capabilities.

SUMMARY

Computer is basically an electronic device. It is mainly used for data processing. Computer comprises of many devices. Its block diagram is shown in figure 2.1.

All those devices, using which data or instructions are provided to the computer are called

input units. Keyboard, Mouse, CD-ROM drive etc. are common input devices.

All those devices of computer, using which it provides result of processing to us are called output devices. VDU, printer etc. are common output devices.

Those devices of computer, on which it stores data permanently so that it could be read later, are called input / output devices. They are called so because they serve the purpose of input and output devices, both. Floppy drive, Hard disk, Magnetic tape drive, Cartridge tape drive, CD-Writer etc. are few examples of Input / Output devices. Since these devices are used for storing bulk data hence they are also called bulk storage devices or secondary storage devices. The medium, on which they store data / information are called permanent memory. For example, floppy drive stores data on floppy. Floppy is often referred to as permanent memory.

Those units, in which computer holds data for some time are called memory. Depending upon the nature and behavior of memory, computer memories are categorized into following categories:

1. *Primary Memory*
2. *Cache Memory*

That memory, which is utilized by the computer for its internal functioning, is called primary memory. It is further categorized into two categories:

1. *Read Only Memory (ROM)*
2. *Random Access Memory (RAM)*

That memory, in which computer performs only read operations is called Read Only Memory. Computer can't write in this memory.

That memory, in which computer performs read and write operations randomly is called Random Access Memory.

Cache memory is fast memory. Its basic objective is to increase the speed of computer. It is placed in between processor and RAM. If it remains present in computer, computer performs all its read write operations in it, instead of performing in RAM. Later whatever is written in it is transferred to RAM. Cache memory makes computer read write operations very fast.

Arithmetic and Logic Unit (ALU) of computer performs all arithmetic and logical operations.

Control Unit of computer ensures movement of right data from right source, to right destination at right time so that all the units of computer perform their functions in coordination with each other.

Computers are basically dumb devices. They perform the tasks according to the instructions given to them by the user. Their working capabilities are much beyond the capabilities of human beings. They can perform a task at very fast speed for long durations without making any mistake.

EXERCISES	CHAPTER 2

Short Type Questions

A. Select most appropriate answer for following questions:

1. Which type of device, a computer is?

   (a) Mechanical   (b) Electrical   (c) Magnetic   (d) Electronic

2. Which part of computer stores data temporarily?

   (a) RAM   (b) ALU   (c) CU   (d) CPU

3. Which of the following device will be used for displaying the result?

   (a) Keyboard   (b) ALU   (c) VDU   (d) Mouse

4. Which of the following can be used for storing the data permanently?

   (a) RAM   (b) Hard disk   (c) Mouse   (d) VDU

5. Which of the following is an example of software?

   (a) Mouse   (b) Memory   (c) Operating System   (d) Printer

6. Which of the following is purely an input device?

   (a) Mouse   (b) Floppy   (c) Hard disk   (d) Printer

7. Which of the following is an not an input/output device?

   (a) Hard disk   (b) Floppy drive

   (c) CD-ROM drive   (d) Magnetic tape drive

8. Which of the following is used for increasing the speed of read write operations in computer ?

   (a) RAM   (b) ROM   (c) Cache memory   (d) Bulk memory

9. Which of the following unit performs all calculations in computer?

   (a) ALU   (b) Memory   (c) Control Unit   (d) Keyboard

10. Which of the following is sequential storage device?

    (a) Hard disk   (b) Magnetic tape drive

    (c) CD-ROM drive   (d)Floppy drive

B. Fill in the blanks:

11. RAM is acronym for ……….……………. …………..……… …………….....…………

12. ROM is acronym for ………….....……… ………….....…… ………………....………

13. PROM is acronym for …………..…… ……….....……………………… …………… ……….

14. CU is acronym for ……………..…………………. ……………… ………… ….

15. ALU is acronym for …………………………………..………. …………… ……………

16. Those devices, using which data is provided to the computer are called .... devices.
17. .... is an example of input device.
18. .... stores data on metallic platters.
19. Floppy drive stores data on .... permanently.
20. .... is an example of secondary storage device.
21. Cache memory in computer is placed in between .... and ....

C. State, true or false for following statements:

22. Keyboard is the main input unit for computer.
23. Floppy drive is an output device.
24. Data, instructions or results can be permanently stored on hard disk.
25. In computer, Control Unit performs all arithmetic and logical operations.
26. ROM programmers are the special devices that are used for writing data in Random Access Memory.
27. Mouse is a pointing device.
28. Drag and drop operations are generally done using keyboard.
29. Speed of RAM is always faster than cache memory speed.
30. Contents can always be written in ROM but not read from it.
31. Computer cannot work without instructions.

D. Differentiate between the following:

32. Input and output units of computer.
33. RAM and ROM.
34. Secondary memory and cache memory.
35. Tension arm tape drive and vacuum column tape drive.
36. Magnetic tape drive and cartridge tape drive
37. Dot matrix printers and inkjet printers.
38. Floppy and CD.
39. Arithmetic operations and logical operations.
40. CD-R and CD-R/W.
41. CD ROM drive and CD Writer.

Detailed Answer Type Questions

E. Answer the following questions in detail:

42. What is computer? For what purpose it is used?
43. Name any three places, where computers can be used?
44. Draw a block diagram of computer and label its component.

45. Describe the role of keyboard and mouse in computer? What are the fundamental similarity and differences between them?

46. Name any two output devices.

47. What is the role of memory in computer? Name any two medium, which serve the purpose of permanent memory.

48. What do you understand by logical operations? Which part of computer performs arithmetic and logical operations?

49. Describe characteristics of computer.

50. What is cache memory? What is its purpose in computer?

51. Describe the functioning of cache memory in computer?

52. Describe the way magnetic tape drive stores data on magnetic tapes.

53. Describe the role ALU in computer?

54. Describe the role of Control Unit in computer.

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Computer Application Theory

CHAPTER 3

Operating System

INTRODUCTION

A computer system is basically combination of hardware and software. For its functioning it requites different types of hardware devices, electronic components and various types of software. Operating system is one of the software, which computer uses for its internal functioning. What operating system is, what are its functions and what types of operating systems are commonly available for use are the issues that are described in this chapter.

OPERATING SYSTEM BASICS

Operating System is essential software that is required for a computer to become operational. It provides functionality to computer hardware, so that electro-mechanical components of it perform read, write and processing functions as human being do.

Without operating system, computer cannot work. In the absence of operating system, neither input devices will be able to provide data to the computer nor memory will be able to store anything it nor processor will be able to process the data nor output devices will be able to show the result. Managing computer's resources and making them work in coordination with each other is the responsibility of operating system.

Any instruction given by the user to the computer to perform a function is actually carried out by operating system. It is the operating system, which on receiving instructions from the user invokes all internal units to perform their duties and workout the result. Details of operating system are described below.

MAJOR FEATURES OF THE OPERATING SYSTEM

Operating system is essential software, purpose of which is to activate the computer and:

1. Perform internal management functions.
2. Provide services.
3. Provide user interface.

Internal management functions are the functions that have to be essentially performed to make the computer work. Services are bunch of commands and utilities that operating system provides to its users to have better control over computer. User Interface is the methodology, using which user interacts with computer. Block diagram, showing the basic structure of operating system is shown in figure 3.1.

Figure 3.1

Management Functions Of Operating system

Essential functions that an operating system performs are:

- Process management function
- Memory management functions
- Information management functions
- Device management functions
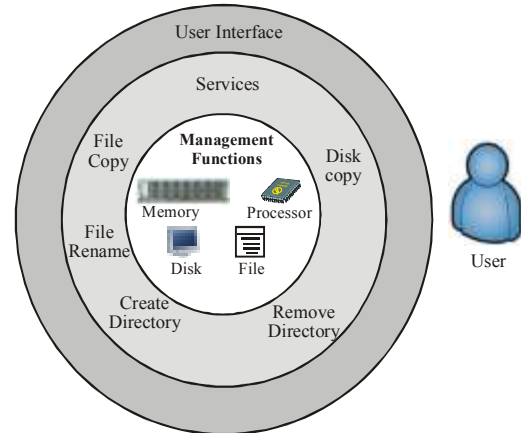
What these functions are, where do they fit in data processing cycle, is explained below.

Process Management Functions

Programs that are to be executed and their data, initially reside within computer's memory. For executing them they are taken to the processor, arithmetic and logical operations are performed within the processor, result of processing are transferred back to the memory and processor is set free for performing other tasks.

All these processor related operations are called process management functions. It is quite obvious that these functions cannot be carried out on their own. Some software is required to perform these functions. Operating system is the software, which performs these process management functions.

Memory Management Functions

All the programs that are to be executed and the result that are to be printed, have to be essentially present in memory. When any such item comes to memory, it is accommodate in some free portion of the memory. If there is no free space, swapping procedure is started.

On the other hand, if any item present in memory is no more required then memory is reclaimed and free space is created. All these functions are memory management functions and are performed by operating system.

Information Management Functions

Permanent storage of information within computer is an essential requirement of any computer environment. For this, data / information is written on the secondary storage devices, in well systematic way. In this process, all arrangements are made to ensure that

new data / information being written on the device doesn't overwrite previously written data / information and afterwards it is easily retrievable in its, original form. All those activities, which are carried out in computers for this objective are called information management functions and are carried out by operating system.

Device Management System

Keyboard, monitor, floppy drive, hard disk etc. are few devices that are part of almost every computer. In computers their functionally is partially controlled by hardware and partially controlled by software.

Operating system is the software that controls these devices. For example, when a command is given from the keyboard, keyboard controller card (hardware) converts it into computer readable form and operating system (software) interprets it and executes it. Similarly disk controller card (hardware) places the read / write head of the disk at appropriate place, and operating system performs the writing function.

Services Provided By Operating System

Apart from performing above mentioned management functions, operating system provides many commands and utilities for doing housekeeping tasks. For example, it may provide utility for:

- Listing the names of all files and directories, present on a disk.
- Copying the contents of a file into another.
- Compressing the file and uncompressing the files.
- De-fragmenting the disk.

User Interface

While working on computer, user has to interact with computer. For example, if a program is to be executed, user has to communicate to the computer that this is the program, which is to be executed.

Note that different operating systems provide different ways of interacting with computer. In computer terminology, the method of interaction is often referred to as user interface. User interfaces are basically of two types:

1. Command Line Interface (CLT).
2. Graphical User Interface (GUI).

Details of both the types of interfaces are given below:

Command Line Interface

In command line interface, user interacts with the computer by typing the commands in specified format. Thus he mostly makes use of keyboard to interact with the computer. For example, to copy the contents of data.dat file in data.bak file, he will have to type the command in following format:

COPY [name of file to be copied] [name of file in which contents have to be copied]

Thus he will type the following contents:

COPY data.dat data.bak

Note that in such type of communications, user has to remember the name and format of the commands. Spelling mistakes and deviations in format lead to errors and the task is not performed.

MS-DOS, Unix, Linux etc. are few operating systems, which provide command line interface. Visual appearance of MS-DOS's command line interface is illustrated in figure 3.2.

Figure 3.2

Graphical User Interface

In graphical User Interface (GUI), user interacts with the computer through graphical items, such as icons, menus dialog boxes etc. As and when required, these items automatically appear on the monitors and user has to simply select his choice from the displayed items, by clicking the mouse on desired option. Thus in this type of communications, user mostly makes use of mouse to interact with computer.

To understand the concept of GUI, refer, menus shown in figure 3.3(a). To invoke de fragmentation program, user need not remember the command name and command format, as he had to do in command line interface. For this, he simply needs to click the mouse on the corresponding option present in the menu. When he does so, computer interacts with him through GUI objects like submenus, dialog boxes, alert boxes etc., as shown in figure 3.3(b)

Windows, Macintosh operating system, OS/2, some versions of Linux, Unix etc. provide graphical user interface to interact with computer.

(a)   **(b)**

Figure 3.3

GUI COMPONENTS

Graphical user interface makes use of following GUI components to make the user interaction easy and interesting:

Program Icons

All those icons that represent program are called program icons. Some of the program icons are illustrated in figure 3.4(a). To run the program, you need to double click the mouse on its program icon. For example, to execute Date/Time program, you will have to double click the mouse on its icon.

Objects Icons

All those icons that represent objects like, devices, files, folders etc. are called object icons. Some of the object icons are illustrated below.

Represents Floppy drive.

Represents hard disk.

Represents a folder.

Represents executable file.

Represents non-executable files.

Represents data file.

Menus

Following types of menus appear in GUI. Each menu provides various options. An option is selected by clicking the mouse on the desired option.

1. Popup menu
2. Shortcut menu
3. Bar menu

List Boxes

List boxes display various choices within a box (names, numbers, symbols etc.). An item of choice is selected by clicking the mouse on it. A list boxes is shown in figure 3.4(d).

Drop Down List Box

Drop down list box is another type of list box that looks like a text box with a down

pointing arrow button on its right hand side. When you click the mouse on the arrow, a list of options drops down. To select any option from this list, you need to click the mouse on it. A drop down list is shown in figure 3.4(d).

Check Boxes

Small square shaped buttons (could be one or more) form check boxes. Labels written near the buttons give an indication of the type of data / information that will get selected, when you click the mouse on it. When you select a check box, a mark gets placed within the check box. If you wish, you could select more than one check box from the group. Check boxes are illustrated in figure 3.4(c).

Radio Buttons

Group of at least two or more rounded buttons form radio buttons. Labels written near buttons give an indication of the type of data/information that will get selected when you click mouse on it. Only one radio button, from the group can be selected. When you select a button, a black dot appears within the selected button. Radio buttons are illustrated in figure 3.4(c).

Spinner

A spinner consists of two arrow buttons and a text box, with some value written into it. One arrow points up and the other points down. When you click the mouse on up arrow, the value in the text box increases. When you click it on down arrow, the value in the text box decreases. A typical spinner is illustrated in figure 3.4(b).

Text box

Text box consists of rectangular blank area, in which contents are typed. A typical text box is illustrated in figure 3.4(d). Note that the label written beside the text box gives the idea of the contents that are to be typed in text box. For example, the label "File name" indicates that the name of the file is to be typed in this text box.

Buttons

Rectangular labels, with some text written on them form buttons. Few buttons are illustrated in figure 3.4(d). When you click the mouse on the button, an action takes place. The text written on the buttons, generally gives an indication of the action, which will take place, when you click the mouse on it. For example, when you click the mouse on "Open" button, the file mentioned in the dialog box gets opened.

Toolbars

A row of small buttons, with icons in them forms a toolbar. Each button perform a specific task when you click the mouse on it. A typical toolbar is illustrated in figure 3.4(a).

Toolbar

Bar menu

Radio Buttons

Icons

Spinner

Check Boxes

(a)   **(b)**   **(c)**

List Box

Text Box

Button

Drop Down List Box

(d)
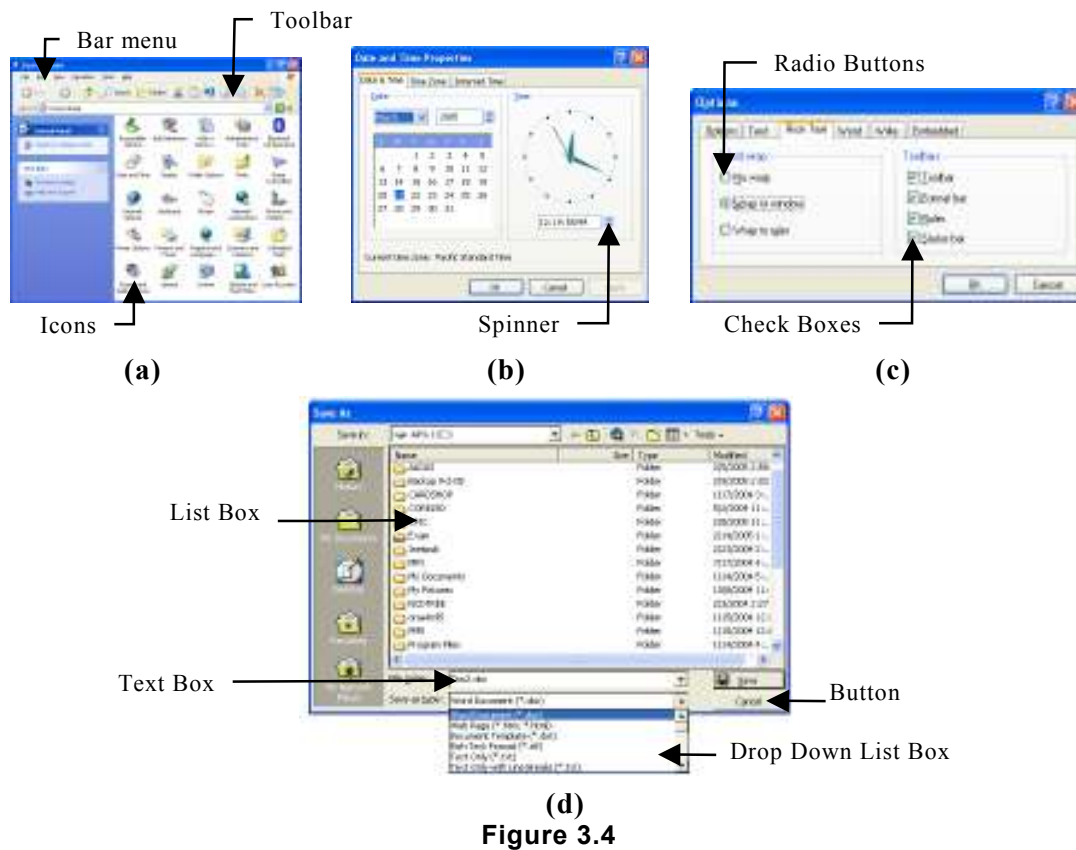
Figure 3.4

MOST DESIRABLE CHARACTERISTICS OF OPERATING SYSTEM

As man's popularity and acceptability depends upon his character, operating system's popularity depends upon its characteristics. Following are the most desirable characteristics of operating systems:

Easy-To -Use

Be it any operating system, it is required that its user interface should be user friendly. Process of invoking commands, utilities and applications should be easy.

Few decades back, when devices like modern monitors and consoles were not available, people had to interact with computer through punch cards and tapes. What data is going into computer could neither be seen nor modified on-line. In those times working on computer was really a tough task. Price and unfriendly user interface were the two factors that were against computer's popularity. Introduction of Character User Interface (CUI) made interaction with computer easy to some extent, but with the advent Graphical User Interface (GUI), problem got solved to large extent. It is due to Graphical User Interface

that even a child can operate computer these days. Hand writing recognition, voice recognition systems etc. are now being incorporated in operating systems. They, coupled with other sophisticated modern hardware devices, are adding new dimensions to computer's functionality. For example, operating system of the table PC supports these features.

Reliability

Performance of the operating system should be reliable. Each time it executes a program, it should produce same result with same efficiency.

It should sustain abrupt power failures and shutdowns. It should not so happen that these hazards corrupt user's data or system files. It is required that operating system should be robust in nature and should withstand all odd conditions.

Speed And Efficiency

Response time is one of the prime factors that attributes to the success of any operating system. Response time of any operating system partly depends upon the quality of the hardware and partly upon the efficiency of the algorithms that has been implemented for internal resource management. It is quite obvious that computer with faster CPU, faster memory etc. will produce faster results. Such a hardware managed by efficient operating system will produce still faster throughputs.

Reusability

With wide variety of processors and other hardware computers available these days, it is required that operating system written for one type of computer should be easily portable to other hardware platforms. This saves time, effort and cost. Object oriented approach for programming promotes reusability to a large extent.

Security

Security is the most desirable characteristic of any operating system. An operating system should provide means for safeguarding system resources from unauthorized users and protection of one user's resources from other users of the system.

With the advent of Internet and local area networks getting popular, even single user computers need to interact with other computers these days. Such situations demand tight security features. Popular operating systems offer these features through incorporation of following:

   (i) Login name.
   (ii) Login password.
   (iii)Read, write, access file permissions.
   (iv) Encryption of data.
   (v) Virus protection software layers.

Adaptability

With the advancement in electronics and its focus on miniaturization, wide variety of plug-in devices has suddenly invaded the market. Each device is meant for getting connected to the computer and working in coordination with other devices. In this scenario, it is desired that operating system should be adaptable enough to accommodate these devices easily.

Quite sometime back, it was very difficult to add new devices to the system. Lot of changes and modifications had to be done in system files to make the new device functional. Now the scenario has completely changed. These days operating systems have large database of device drivers built into them. They support plug and play feature. They automatically sense the presence of new device in the system and load corresponding device drive automatically. Operating systems have helpful wizards incorporated in them. In all those events, in which they fall short of any data, software or hardware, wizards is invoked automatically. Wizard guides the user to perform all necessary steps for making the device /system operational.

Compatibility

Data communication and resource sharing are the two prime activities that need to take place in most of the working environments these days. Wide variety of hardware, operating systems, and applications need to interact with each other. So it is highly desirable that operating system should be communication protocol rich so that it is compatible with other operating systems. Files and programs of other computers should be accessible in the same way, as files and programs of local computer remain available.

Most of the operating systems these days are compatible with other operating systems. Effective protocols and software layers have been incorporated in operating system to promote compatibility issue.

It is also desired that Internet connectivity and accessibility issues are inbuilt into operating system. No addition and alterations should be externally required. For example, in the earlier days of Windows-95 operating system, many software and utilities (including internet explore) had to be installed on top of operating system to get connected to Internet and avail its services. But in the later versions like Window-98, Window-XP etc. these services became integral part of the operating system. As soon as operating system is installed on computer, it becomes ready for Internet access.

Multimedia Support

Computer is no more data crunching tool now. It is more like multimedia electronic device. Its usage is no more limited to numbers and words. Graphics, sound, animation, video etc. fall within the preview of its capabilities.

These days it is desired that operating system should support all multimedia features to accommodate wide range of multimedia hardware devices. Multimedia operations like photo editing, sound editing and playing, animation and video effect etc. should be possible on computer.

GUI based operating system of modern times, like Windows, Linux etc. provide strong support for multimedia operations.

You are now familiar with some of the most desired characteristics of operating systems. Characteristics mentioned above are part of most popular operating systems of today. Some of the characteristics that are not part of modern operating system, but are very much required because of change in computing requirement are described below.

MOST DESIRED ADVANCED FEATURES IN MODERN OPERATING SYSTEMS

Networking along with Internet has completely changed computing scenario in modern times. They have turned the globe into global village. Physical location of data, devices and user of an application are no more required to be confined to single geographical location.

For example, a user in India may have to store his data on three different computers that are placed in three different countries (say America, France, and Australia). With such type of requirements taking place, modern operating system should support following features:

    (i) Seamless Distributed Computing

    (ii) Seamless Distributed Database

    (ii) Global User Management

    (iv) Universal Environment

    (v) Composed Based Operating System.

Seamless Distributed Computing

Seamless distributed computing refers to the feature that if A, B, and C computers are in network and you are sitting on computer B, whenever, you fall short of resources (like CPU time, memory space etc.), operating system should ensure that you are efficiently allocated resources of A and C so that your task is completed effortlessly. This feature of operating system is the demand of the day.

Seamless Distributed File System Database

File systems should allow the user to create cabinets on their computer, in which they set few parameters so that when they use cabinets, files show up there as if they were any other folder. File system should also allow the user to set the scope of the cabinet, local, network or world wide. The physical location of files should be irrelevant. This feature should be part of operating system today.

Global User Management

Operating systems of modern times should have global user management feature built into them, so that when user activates his OS, he should be given a global account where his preferences and other key settings are stored along with the data, which he chooses to store there. In that space, all his e-mails, favorites and other system specific stuff could also be

kept so that all this stuff doesn't become local to the computer, on which he is working today. Tomorrow if he works on other computer, his global stuff should be accessible.

Apart from this, if he is working on other computer, OS should allow him to lift the data from other computer on which he worked previously.

Universal Environment

It is highly desirable that operating system of modern times should support the feature of Universal Environment so that when a user shifts from his computer to public computer, the same working environment (program setting etc.) is provided to him and his programs work well on other computers also.

Component Base Operating System

In the era of open system, it is desired that it should be possible for others to modify the OS code, so that its capabilities and services could be enhanced.

TYPES OF OPERATING SYSTEMS

Various types of operating systems are available for use. For example, MS-DOS, Windows, Linux, Unix etc. are the names, of few popular operating systems.

Although all of them perform above-mentioned management functions but they differ from each other in terms of capabilities, user interface and services that they extend to their users. Operating systems can be broadly classified into following categories:

1. Single user operating systems
2. Multi user operating systems
3. Network operating systems

A detailed description of all the types of operating systems is given below.

Figure 3.5

Single User Operating Systems

Single user operating systems are those operating systems, which allow only one user to work on the system at a time. In no way, multiple users can work on the system simultaneously. Concept of single user operating system is illustrated in figure 3.5.

Single user operating systems can be broadly categorized into two categories:

1. Single user single task operating systems.
2. Single user multitasking operating systems

Single user single task operating systems allow user to execute one program at a time. For example, if he is preparing a worksheet on computer, he cannot print a report on the printer. As soon as he invokes a program, computer gets dedicated to that task only. CP/M, MS-DOS etc. are few examples of single user single task operating systems.

Single user multitasking operating systems allows user to execute more than one programs at a time. For example, while he is preparing a worksheet on computer, he can print a
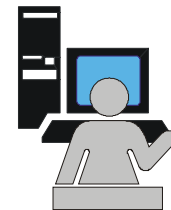
report on the printer and play music too. Practically there is no limit from operating system's side for the number of tasks that can be executed simultaneously. Physical size of the memory (hardware available) puts the limitation. Windows Me, Windows-XP, Macintosh operating system, OS/2 etc are few examples of single user multitasking operating systems.

Multi-User Operating Systems

Multi-User operating systems are larger and more complex operating systems. They allow multiple users to work on the system simultaneously. Concept of multi-user operating system is illustrated in figure 3.6.

Following are the features of multi-user operating systems, which are not provided in single user operating systems.

- Time sharing (CPU devotes time to all the users in round robin fashion).
- Tight security features.
- Resource sharing among users.
- System administrator privileges.

Figure 3.6

Linux, Unix, VMS etc. are few examples of multi-user operating systems.
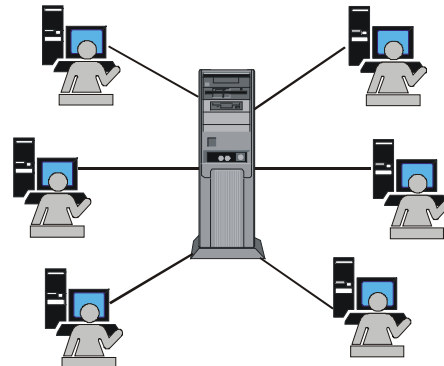
Network Operating System

When two or more computers are connected to each other with the objective of sharing their resources, they form a computer network. A network operating system is an operating system, which includes special functions, protocols and device drivers for connecting the computers of the network. When a computer is booted with network operating system, all computers get connected together and the network becomes operational. When network becomes operational:

- Security features get implemented
- Devices of one computer can be used by other network users.
- Files can be shared among them.
- They can communicate with each other, sending mail and messages.

Windows-NT, Windows-2000 server, Windows server 3000, Novell Netware, IBM AIX, Red Hat Linux etc. are few examples of network operating systems.

PC Operating System - DOS

MS-DOS is one of the most popular, powerful and useful operating system. It was designed and developed in the initial days of Personal Computers (PC) by Microsoft Corporation of USA. Due to its versatility and ease of operations, it became quite popular, within short span of time.

MS-DOS is single user single task character user interface (CUI) based operating system. To execute any command in MS-DOS, you need to know the command and its format. Any mistake in its spelling or format leads to error in command's execution.

MS-DOS not only activates computer resources and controls them but it also provides many commands for performing day-to-day tasks.

Architecture Of MS-DOS

MS-DOS is a modular operating system and comprises of many files. It utilizes these files as and when required. Following files put together constitute MS-DOS operating system.

1.   IO.SYS
2.   MSDOS.SYS
3.   COMMAND.COM
4.   Many external command files

Basic architecture of MS-DOS operating system is illustrated in figure 3.7 and role of each file is explained below.

MS-DOS Operating System

IO.SYS
MS-DOS.SYS
COMMAND.COM
External Commands (In the form of Executable File)

Figure 3.7

IO.SYS File

This is one of the most fundamental files of MS-DOS. It
gets loaded into computer's memory at the time of booting the system. It primarily activates basic input and output devices like keyboard, VDU etc. and makes them functional.

MSDOS.SYS File

This file is also one of the fundamental files of MS-DOS. It automatically gets loaded at the time of booting the operating system. It controls internal resources like memory, ALU, Control Unit etc. of computer. When it gets executed, memory, ALU, control unit etc. become functional.

COMMAND.COM File

This is the third fundamental file of MS-DOS operating system. It comprises of few frequently used MS-DOS commands. When you boot the system, it gets automatically loaded into computer's memory. After booting the system, commands contained in it, remain resident in the main memory. This is the reason, why they are also called internal commands or resident commands. For example, DIR, COPY, TYPE, REN etc. are internal commands of MS-DOS and reside in COMMAND.COM file.

To execute an internal command, you need to type the command from the keyboard in its recommended format. When you do so, it is directly read from the memory and executed. Role and function of commonly used internal command are described later in this chapter.

External Commands

MS-DOS comprises of many external commands. Each command exists in the form of executable file and resides on the disk. For example, FORMAT, XCOPY etc. are the

examples of external commands. They exist in the form of FORMAT.COM, XCOPY.EXE files respectively.

To execute an external command, you need to type the name of the command from the keyboard and press Enter key. When you do so, computer reads the file from the disk, loads it into memory and executes it. When its execution is complete, it is removed from the memory. Role and functions of few external commands are described later in this chapter.

File Naming Convention

In MS-DOS, file name comprises of two parts. First part is called primary name and second part is called extension. Both the parts remain separated from each other by a dot. Primary name can be at most 8 characters long and extension can be at most 3 characters long. The name can either be written in upper case or lower case letters but operating system stores all the file names in upper case only. As per rules, mathematical signs like +,-,*,/ etc. can not be used in constituting the file name. Following is the general format on MS-DOS file name:

$$\underline{XXXXXXXX} \textbf{.} \underline{XXX}$$

8 character of primary name   dot   3 characters of extension.
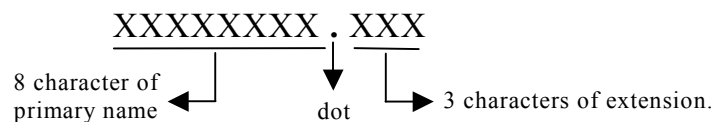
For example, DELL.COM, PLOT.DAT, MONTH12.BAK, YR.AS, RIGHT.DOC etc. are valid file names:

Concept Of Directory

Directory can be conceptualized as special file, which could hold files and directories in it. Concept of directory is illustrated in figure 3.8. Refer this figure and note that D1 is a directory, which holds two files F1 and F2 in it. It also contains a directory D2 in it. D2 holds files F3 and F4 in it.

From this figure, it is quire clear that directories can be utilized for classified storage of files on the disk. For example, directory named LETTER could be utilized for storing all letters in it. Similarly the directory CPROGRAM could be used for storing all the programs written in C language.

Directory-D1

File-F1   File-F2

Directory-D2

File-F3   File-F4

Figure 3.8

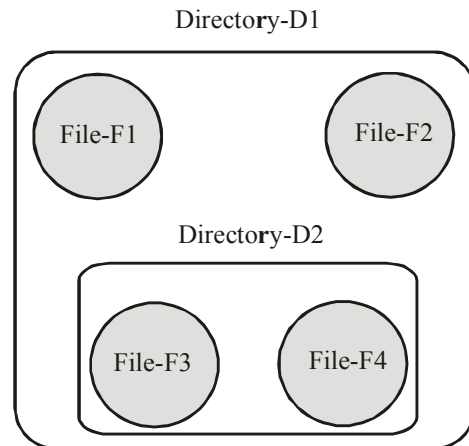### Concept Of Root Directory

Root directory can be conceptualized as the top most directory, which holds other directories and files in it.

Whenever you use any disk for the first time, root directory gets automatically created on it. Other files and directories that are created thereafter are created within root directory. In MS-DOS, root directory is denoted by back slash (\) sign.

Concept Of Parent Directory

Parent directory is the directory, in which you create another directory. For example, if directory D2 is created in directory D1 then D1 directory will be called parent directory of D2. Similarly if directory D3 is created in directory D2 then D2 will be the parent directory for D3. Parent directory is denoted by double dot (..) symbol.

Current Directory

Once you have directories within directory you can always change your position from one directory to another directory. The directory within which you are currently placed is called current directory. For example, if you are currently placed in directory D1 then D1 will be called current directory. When you have moved from directory D1 to D3 then D3 will be the current directory.

MS-DOS File System

The mechanism of arranging the files and directories on the disk is called File System. In MS-DOS, file system looks like an inverted tree. Root directory appears at the top of the tree. Other directories branch off from there and files act as leafs.

Such a file arrangement is often referred to as hierarchical file system. A hierarchical file system consisting of few files and directories is illustrated in figure 3.9.

Note that root directory is at the top of the tree. Root directory contains two directories D1, D2 and a file, named "File F1" in it. D1 and D2 further contain subdirectories and files in them. Note that directories in MS-DOS follow the same naming convention that files do. Generally the directories are assigned a name, which gives an indication of the type of files contained in them. For example, the name DOCUMENT could be used for storing document files in it. Similarly SALARY directory could be used for storing pay related files.
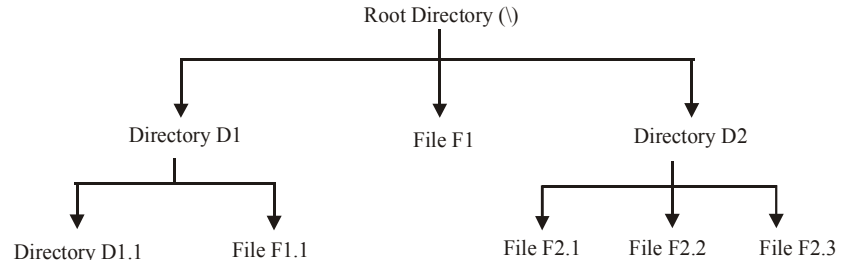
Figure 3.9

Concept Of Path

Path of a file or directory is the list of directory names in descending sequence, starting from root and each directory name separated by a back slash (\), following which you reach to the desired file or directory. For example, refer figure 3.8. The path for file F1.1 will be \D1\F1.1. Similarly the path name for F2.2 file will be \D2\F2.2. Note that first backslash in the path name denotes root directory, while other backslashes serve the purpose of separators.

MS-DOS COMMANDS

Following are few commonly used MS-DOS commands:

DIR Command

DIR command is used for displaying the names of all the files residing on media like floppy hard disk, CD etc. In its simplest form it can be executed in following format:

C:\> DIR [Enter]

This command will display the names of all the files present on C: disk, in the following format:

Volume in drive C is RAMESH
Volume Serial Number is 36F7-808
Directory of C:

COMMAND	**COM**	**54,645**	**06-11-99**	**7:21a**
DATA	**DAT**	**732**	**07-12-99**	**6:20p**
REPORT	**DOC**	**3,210**	**05-05-98**	**5:40p**
DOIT	**BAK**	**734**	**05-06-99**	**2:25a**
TOTAL	**DAT**	**351**	**10-10-99**	**5:25p**
EXAM	**LET**	**357**	**08-08-99**	**6:37p**

6 file(s)   **60,029 bytes**
                                18, 376, 520 bytes free

EDIT Command

EDIT command is used to create a text file and type text in it. It is executed in the following format:

EDIT [drive:] [file name] [Enter]

Here, in this format, **"drive:"** is the name of that drive, on which the file is to be created and "file name" is the name, by which the file is to be created. For example, following command will create MYFILE.TXT file on default drive:

EDIT MYFILE.TXT [Enter]

Figure 3.10

After execution of this command, a window, as illustrated in figure 3.10 will appear on the screen:

After getting the window on the screen, type the text as per instructions given in the following table:
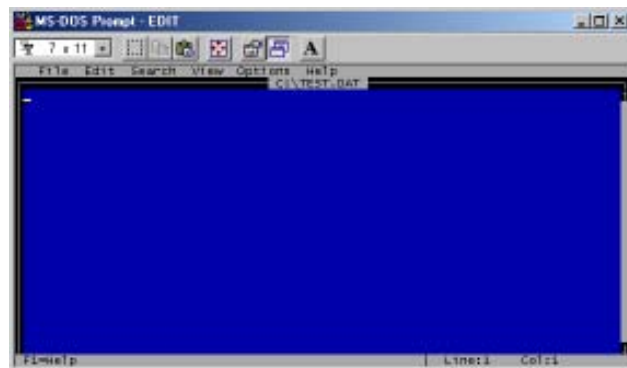
Sr.No.	Task	Action
1.	Type the text	Use character keys of the keyboard to type the text.
2.	Take the cursor to the desired line and column.	Use arrow keys.
3.	Delete a word	Take the cursor to the beginning of the word and press CTRL and T keys together.
4.	Delete a line	Take the cursor to the line, which is to be deleted and then press CTRL and Y keys together.
5.	Insert text	Take the cursor to the place where text is to be inserted and start typing the text.
6.	Inserting a line between two lines	Take the cursor to the line, which is to be shifted below. After this, press Enter key.
7.	Save the file	Press ALT and F keys together and then press S key.
8.	Come out of EDIT	Press ALT and F keys together and then press X key.

TYPE Command

TYPE command is used for displaying the contents of a file on VDU. It is executed in the following format:

        TYPE <file name.> [Enter]

Here, in this format, <file name> is the name of that file, contents of which are to be displayed on the screen. For example, if you wish to view the contents of MYFILE.TXT then following command is to be given:

        TYPE A:TEST [Enter]

COPY Command

COPY command is used to make a duplicate copy of a given file. It is executed in the following format:

        COPY <Source file name> <Destination file name>   [Enter]

Here in this format "Source file name" is the name of the file, which you wish to copy and "Destination file name" is the name of the file, in which the contents have to be copied. For example, if the contents of "MYFILE.TXT" file are to be copied in "MYFILE.BAK" then COPY command will have to be executed, as mentioned below.

        COPY MYFILE.DAT MYFILE.BAK

REN Command

REN command is used for renaming an existing file. General syntax for REN command is as follows:

        REN <Existing file name> <New file name>   [Enter]

To understand the usage of REN command, consider the following examples:

    REN DATA.DAT INFO.TXT [Enter]

This command will change the name of DATA.DAT file to INFO.TXT.

DEL Command

DEL command is used for removing a file from the disk. In its simplest form, it can be executed as follows:

    DEL <File name>   [Enter]

Here, in this format, "File name" is the name of the file along with drive reference, which is to be removed from the disk. To understand the usage of DEL command, consider the following examples:

    DEL A:DATA.DAT   [Enter]

This command will remove DATA.DAT file from A: drive.

CD Or CHDIR Command

CD is short form of Change Directory. It is used for moving the current position from one directory to another directory. General format for CD command is as follows:

    CD <Directory name>   [Enter]

Here, in this format "Directory name" is the name of that directory, to which you wish to move. To understand the usage and functioning of CD command, consider the following example:

If current directory has a directory named SECOND in it and you wish to move to that directory then CD SECOND, command will have to be given.

If you wish to move to root directory then CD \ command will have to be given.

If you wish to move to the parent directory then CD **..** command will have to be given.

If you execute CD command, without any file name, the name of current directory gets displayed.

MD Or MKDIR Command

MD is short form of Make Directory. This command is used for creating a new directory. It is used in the following format:

    MD <Directory name>   [Enter]

Here, in this format, "Directory name" is the name that is to be assigned to the newly created directory. For example, if you wish to make a new directory with the name, "LETTERS", following command will have to be given:

    MD LETTERS [Enter]

Note that when you make a directory, it is made in the current directory

RD Or RMDIR Command

RD is short form of Remove Directory. This command is used for removing the directory from the disk, provided it is blank. It is used in the following format:

RD <Directory name>   [Enter]

Here, in this format, "Directory name" is the name of that directory, which is to be removed. For example, if you wish to remove LETTERS directory, following command will have to be given:

RD LETTERS [Enter]

SYS Command

SYS command is used to make a media, like floppy, hard disk etc. bootable. While making it bootable, it copies IO.SYS, MSDOS.SYS and COMMAND.COM files at specific location on the media. Note that, since these files are copied at specific location hence the media becomes bootable. On the other hand, if you copy these files to the media, using COPY command, media will not become bootable. SYS command is used in the following format:

SYS <Drive name>   [Enter]

Here, in this format, "Drive name" is the name of the drive that contains the media, which is to be made bootable. For example, if floppy in drive A: is to be made bootable, following command will have to be executed:

SYS A: [Enter]

FORMAT Command

Format command makes tracks and sectors on the media, like floppy or hard disk. It is executed in the following format:

FORMAT [Drive name]

Here, in this format, "Drive name" is the name of that drive that holds the media, which is to be formatted. For example, if you execute "FORMAT A:" command then the floppy, present in A: drive will get formatted.

MOVE Command

MOVE command, physically moves files and directories from one place to another. It is used in the following format:

MOVE <Source file name>   <Destination directory>

Here, in this format, "Source file" is the name of the file, which is to be moved from its current location to another directory. "Destination directory" is the name of that directory, in which the file is to be transferred. For example, if you wish to move SUM file into GTOTAL directory of root then following command will have to be given:

MOVE SUM GTOTAL   [Enter]

MOVE command can also be used for renaming the directories, as illustrated in the following example:

        MOVE JAN   MONTH   [Enter]

Above-mentioned command will rename JAN directory to MONTH.

DISKCOPY Command

DISKCOPY command is used for duplicating the contents of a given floppy. When you make use of this command, all files and directories of one floppy get copied to another floppy. In its simplest form, it can be executed as follows:

        DISKCOPY   <Source drive>   <Destination drive>

Here, in this format, "Source drive" is the name of that drive, which contains the floppy, whose contents are to be duplicated. "Destination drive" is the name of that drive, which holds the floppy, on which the contents have to be copied. For Example, if you wish to copy the contents from drive A: to B: drive then following command will have to be given:

        DISKCOPY A: B: [Enter]

WINDOWS OPERATING SYSTEM

Windows is the most popular operating system of modern times. It has been designed and developed by Microsoft Corporation of United States of America for Personal Computers.

Windows is single user multitasking GUI based operating system. It not only activates computer and makes its devices functional, but it also provides numerous applications for performing wide variety of tasks.

File Naming Convention In Windows

As you know, file is a medium to store data and information on computer. File is always identified by its name and the same name is used while operating upon it.

Recall that MS-DOS allows maximum 8 characters in primary name and three characters for extension name. Primary name and extension name are always separated by dot (.). The pattern of file names in Windows is slightly different from MS-DOS. Following points apply on file names in Windows:

1. File name can be up to 255 characters long.
2. Blank and dot (.) can also be used in file names. For example "My File" is a valid file name.
3. Characters like + ;   [=   ] etc. can also be used in file names
4. Characters like \ / : * ? " are still prohibited in file names.

Concept Of Folder

Folder is a special file, which is capable of holding other files and folders into it. In MS-DOS operating system they were called directory. In Windows, they are called folders.

Features Of Windows Operating System

Following are the features of Windows operating system:

GUI based Operating System

Windows is Graphical User Interface based operating system. It provides very simple, yet powerful and interesting mechanism for interacting with computer. It is a user-friendly operating system.

Multitasking Operating System

Windows is multitasking operating system. Thus in Windows, you can perform multiple tasks simultaneously. For example, while typing the letter through keyboard, you can view a movie on VDU and print the report on printer too.

Drag And Drop

Drag and Drop is a powerful feature of Windows. Using this feature, you can drag objects like files, folders etc. from their original location and drop them at some other place, with the help of mouse so that they could either be copied or moved there. For example, dragging file A, present in folder F1 and dropping it on folder F2 will move the file A from F1 to F2.

CUT COPY And PASTE

Cut, Copy and Paste is powerful feature of Windows. Using this feature, selected items like text, graphics, icons etc. can either be copied from their original place to a temporary memory location called Clipboard or from Clipboard to the desired location. Thus you can either move these items from one place to other or make duplicate copies of them. For example, when you select an item and perform CUT operation on it, it physically moves from its original place to the Clipboard. When you move to some other location and perform PASTE operation there, the item from Clipboard gets copied to the current location. Thus at the end of CUT-PASTE operation, selected item changes its place. Similarly when you perform COPY operation on a selected item, it gets copied into Clipboard (doesn't get removed from its original place, as it happens in the case of CUT operation). After this, when you change your current location and perform PASTE operation there, contents of Clipboard get copied to the new location. Thus a duplicate copy of the selected description gets made.

Object Embedding

This is one of the most powerful features of Windows operating system. It enables two or more programs to exchange objects like text, graphics etc. among them. For example, a drawing made in Paint program could be brought into the document, created through WordPad program so that figure could be embedded in the text. For example, you may type the description of Kutubminar in WordPad program and may draw the figure in Paint program. Using object embedding feature of Windows, you could place the figure of Kutubminar in Kutubminar text, so that it becomes complete text in itself.

Object Linking

Object linking is yet another powerful feature of Windows operating system. Using this feature, one object can be linked to the other object. Thus whenever linked object is modified or changed modifications/changes get visible in other object also. For example, you may type the description of Personal Computer in WordPad program and draw its figure in Paint program. Using object linking feature, you may link the computer figure to computer description so that it appears in the document (as it did in case of object embedding). Now whenever you will make modifications / changes in computer figure they will automatically get reflected in the description. You may note that overall effect of object embedding and object linking is same but automatic reflection of changes / modifications doesn't take place in case of object embedding.

Plug And Play

It is an important feature of Windows operating system. It makes the operating system, slightly intelligent. Whenever you attach a new device to the computer, operating system automatically senses its attachment and loads its device driver. Thus due to plug and play feature, new devices become automatically operational in Windows operating system.

Command Prompt

Using this feature, Windows provides MS-DOS working environment, within Windows environment. Thus all MS-DOS commands can be executed from Windows.

Useful Programs Of Windows

Windows is a powerful operating system. It not only makes the computer functional, it also provides many useful programs. Using these programs, you can perform different types of operations. Following are commonly used programs of windows:

Notepad   This program is used for creating small text files.

WordPad   This program is used for creating large text files. It also provides many formatting options, using which the document could be formatted and made attractive.

Paint   It is basically a drawing and coloring program. Using this program, you can create shapes and drawings and color them with attractive colors.

Calculator   Using this program you can use your computer as calculator and perform arithmetic and scientific calculations.

Media Player   Using this program, you can play audio and video files on you computer.

Movie Maker   Using this program, you can put graphical pictures in sequence and prepare multimedia presentations.

Windows Explorer   Windows Explorer is a program, using which file and folder maintenance activities are performed on computer. Creating new folders, deleting old folders, moving or copying files from one folder to another are the activities, which are easily performed with

	the help of Windows Explorer.
Internet Explorer	Internet Explorer is basically a browser, using which activities like net surfing, net search, e-mail etc. are performed.

Different versions of Windows are available for use. They all are look-alike GUI based operating systems. They support all above mentioned features and utilities, but differ from each other in terms of their capabilities and additional facilities. Few popular versions of Windows are described below.

WINDOWS-9X

The term Windows 9x refers to three operating systems viz. Windows-95, Windows-98 and Windows-me.

As the names indicate, Windows-95 was released in the year 1995. It was plain and simple operating system, mainly developed for stand-alone computers. It did not have Internet features and utilities in it. For Internet operations, add-on software had to be installed on top of it. Windows-95 is now obsolete.

Windows-98 was released in the year 1998. In was enhanced version of Windows-95. Internet related aspects were included in it and Internet Explorer, the web browser, was made part of it. It became very popular within short span of time. There are many people who are still using Windows-98 today.

Another version of Windows, called Windows-me was released in the year 2000. Me stands for millennium. It was released as enhanced version of Windows-98 but had many internal problems, due to which it used to frequently crash. Windows-me had improved multimedia capabilities, video editing features and enhanced Internet facilities.

WINDOWS XP

Yet another improved version of Windows, called Windows-XP was released in the year 2001. It is 32-bit operating system that is quite popular on personal computers and laptops. It is quite stable product and is being continuously used till date. Many variations of Windows XP are there. They are named as Windows XP Professional, Windows XP Home, Windows XP Media center Editing and Windows-XP Embedded. For processors like Opteron operation, Athlon etc, which are 64 bit CPUs, Microsoft has created 64-bit version of Windows-XP to run on them.

Some of the existing features of Windows XP are given below:

1. **Built on the Windows-NT Engine**: It is built on the field proven code of Windows-NT and Windows 2000, which are 32-bit operating systems and support fully protected memory model. Due to this feature, Windows XP is quite stable and provides secure working environment.

2. **Enhanced Device Driver Verification**: When you install a new service on the system, Window, XP tests its driver rigorously. If the driver passes the test, its stability is ensured. This feature makes sure that system remains stable in most of the odd situations.

3. **Windows File Protection Mechanism**: This features protects core system files from being overwritten by the installation applications. If a file is over written, "Windows file protection" feature will restore the correct version of the file.

4. **Preemptive Multitasking Architecture**: Due to this feature, multi-tasking mechanism has been improved in Windows-XP. It now ensures better response and better stability.

5. **Scalable Memory and Processor Support**: Due to this feature, memory up to 4GB and two symmetric microprocessors can be supported in the system.

6. **Improvised Protection Mechanism**: Protection mechanisms have been improved at encryption and decryption level and at communication and transportation level also. Thus XP protects the information from hackers to a large extent.

7. **Smart Card Support**: Smart card capabilities have been included in the operating system. It builds faster and easier working environment.

8. **Firewall Enhancements**: To reduce the network risk and build tight security zone, lot of firewall features have been included within the operating system.

9. **Fresh Visual Design**: Although the working environment in Windows XP is quite similar to that of its elder brothers, Windows-9x, but it has a free look.

10. **Rich Digital Media Support**: Windows-XP provides rich digital media support. Its digital media player version 9 is quite powerful and provides facilities for:
    - *view rich media information.*
    - *receive best possible audio/video quality.*
    - *tune to at least 3,000 internet radio stations.*
    - *Create custom CDs that are very fast.*
    - *view DVD movies.*

11. **Integrated CD burring support**: Utilities for writing on CD-R and CD-RW have been incorporated in Windows Explorer of Windows-XP. Now the user need not buy third party software for it.

12. **Dual view**: In Windows-XP, a single computer desktop can be displayed on two monitors.

13. **Enhanced Customization Features**: Rich customization facilities have been incorporated in Windows-XP. Using these utilities, users and administrators can configure, customize and troubleshoot numerous Windows-XP functions.

WINDOWS-NT

Windows-NT is a 32 bit operating system that supports preemptive multitasking. Preemptive in respect to operating system means the ability of operating system to preempt or stop a currently scheduled task in favor of higher priority task.

Windows-NT is basically a network operating system. There are two versions of NT:

1. Windows NT Server.

2. Windows NT workstation.

A brief description of both is given below.

Windows NT Server

Windows NT Server, as the name suggests, is designed to act as a server in network. It is multi purpose network operating system that integrates variety of network services in it.

Its software tool named, Microsoft management tool, helps in managing network and Internet operations. It supports high security features to safeguard the system from unauthorized users. Strong file protection mechanisms have been built into the operating system to safeguard users files and folders from others.

System policy editor and user profile features allow managing and maintaining user's desktops. System policies can be used to standardize desktop configuration, enforce behavior and control user work environment and actions.

Windows-NT Server's Network Monitor tool enables network administrators to examine network traffic and control it. Strong authentication certificate verification facilities have been built in the operating system so as to make it suitable for digital certificate related operations. Note that such operations are very much required in e-commerce functions.

File related, powerful, features are part of Windows-NT Server operating system. This features enables large data storage and on-line backup facility. The data written on one disk is also written on other disk (data redundancy), so that in the event of one-disk-crash, it could be retrieved from other disk.

On the whole, Windows-NT server is a robust operating system. It enjoyed populating for quite long but now other operating systems from the same manufacturer have replaced it.

Windows-NT Workstation

Windows-NT, as you know is a network operating system. In client server architecture mode of networking, Windows-NT Workstation operating system is for all those computers, which are connected to the network in client mode. In it looks, it resembles Windows-95 or Windows-98 but is an entirely different operating system. Being part of Network environment, it has tight security features and network features incorporated in it. It promotes distribute data processing as well as stand alone mode of operations.

Note that with the advent of Windows-2000, Windows-NT server and Windows-Workstation operating systems, both are almost obsolete now.

WINDOWS-2000

Windows-2000 operating system came as replacement of Windows-NT. It is basically GUI based network operating system. It has been designed for uniprocessor and symmetric multi-processors based computers. It is 32-bit operating system. Its working in it environment looks like its elder brothers, Windows-NT, Windows 9x etc. As the name indicates, it was released in the year 2000. Its four version are:

1. Windows-2000 Professional.

2. Windows-2000 Server standard edition.
3. Windows-2000 Advanced server edition.
4. Windows-2000 Data center server.

Windows-2000 Professional is Microsoft's mainstream desktop operating system for business of all sizes. It provides high level of security, state-of-the-art features for mobile users and enhanced throughputs. In its capabilities, it falls a bit lower than Windows-2000 server edition.

Windows-2000 Server standard edition is an operating system for network servers. It suits well for business of average size and the computers with maximum 2 processors.

Windows-2000 advanced server edition is a powerful operating system. It has been designed for multiprocessor computers, which have up to 4 microprocessors in them. It provides enhanced memory support and more rigorous printing facilities for great print load operations. Additional features for network balancing have been incorporated in this version.

Windows-2000 Data Center server is the most powerful operating system of this series. It has been designed and developed for high-end voluminous data handling operations. It is capable of handling up to 32 processor based computers.

Windows-2000 is known as hybrid kernel operating system. Architecturally it is divided into 2 modes:

1. User mode
2. Kernel mode

Kernel mode provides unlimited access to system resources and facilities, while user mode is heavily restricted mode. All the versions of Windows-2000 look alike in their looks and provide common functionality. They also support Windows-NT file system, called NTFS 5. It is a robots operating system and is quite popular.

LINUX

Linux is basically multi user, multitasking operating system. It provides character user interface and graphical user interface both for interacting with computer.

It was originally designed and developed by Linux Benedict Torvalds in the year 1991. Basic objective behind developing Linux was to bring out an operating system, which was low in cost and had the power of UNIX operating system. Linux got his operating system included in GNU project of Free Software Foundation, to make it available free of cost, all across the world. Its core version is available free of cost to everyone. Many software-developing companies have incorporated many functionalities into it and are marketing it. Red Hat's Linux is one such operating system and many more also exist.

Linux also has powerful networking features incorporated into it and has built in Internet facilities.

Linux has gained popularity these days and is emerging as a parallel competitor of Windows and Unix operating systems.

Linux operating system provides both types of user interface. It supports CUI and GUI both. Graphical Interface of Linux provides windows look alike working environment. Features like drag and drop, Cut and paste, file sharing, multitasking etc. are also available in Linux.

Character User Interface of Linux is really powerful and provides thousands of commands for doing wide variety of tasks. Using Linux's meta language and shell features, many commands can be coupled together and new commands can be formed. Following are few Linux commands, which are used in day-to-day functions:

ls	:	This command displays the names of all the files present in current directory.
cat	:	This command displays the contents of a file.
cp	:	This command copies the contents of a file into another file.
mv	:	This command moves a file from one directory to another directory.
mkdir	:	This command makes a new directory.
rmdir	:	This command removes a blank directory.
cd	:	Using this command, user can move from one directory to another.
pwd	:	This command shows the name of current directory.
vi	:	Using this command, a new file can be edited and text written in it.
lp	:	This command prints a file on the printer.
passwd	:	This command is used for changing the password.
chown	:	This command changes the ownership of a file.
chmod	:	This command changes file permissions.
who	:	Names of all current users get list through this command.
ps	:	Names of all processes, currently running on the system get listed by this command.
find	:	This command is used for finding, if the file of given name is present on the disk or not.
grep	:	This command is used for searching the occurrences of a given string in a file.
sort	:	This command sorts the given contents either in ascending or descending order.
write	:	Using this command one user can send text message to other user, who is currently on-line in multi-user environment.
mail	:	This command is used for sending e-mails to other users of the system.

Linux is a powerful operating system, which is getting more and more popular every day. Most of the hardware vendors have started bundling their products with Linux. Large

population of Personal Computers (PC) and Laptops comes with preloaded Linux, these days. It is likely to gain more popularity in coming future.

WHAT IS BOOTING?

The process of loading the operating system in computer's memory is called booting. When you switch on the computer, it reads a special program, called bootstrap program from ROM and execute it. On its execution, it carries out a self-test. During self test all the peripherals and devices of computer are checked. If any fault is found in them a corresponding errors message is displayed on the monitor and booting process stops. On the other hand, if no peripheral is found faculty, operating system is read from the disk and loaded into computers memory. At the end of booting process computer becomes ready for accepting commands, executing them and displaying result. Booting is the first and foremost task that is to be performed when computer is to be used.

Note that through tunable parameters, booting device searching sequence can be set for the computer. Once this sequence is set, computer looks for operating system on the devices mentioned in device searching sequence. For example, if the booting sequence has been set as hard disk, CD drive and floppy drive then first computer will search the operating system on hard disk. If it gets it there, it will load it in computer's memory. If it doesn't get it there, it will search it on CD drive. If it gets it there it will load it else it will search the floppy drive. If it doesn't get it on any of the drives, it will display corresponding error message. As mentioned above, this booting search sequence can be changed as per requirements.

WHAT IS SHUTDOWN?

The process of switching the computer off is called shutdown. The procedure for shutdown varies from operating system to operating system. During shutdown, computer stops all running processes, saves current settings, closes all opened files and disconnects from all the links.

SUMMARY ───────────────────────

Operating System is the most essential software for the functioning of computer. It activates all the units of computer and makes it capable of accepting commands from the users and executing them. Without operating system, computer cannot work.

Before starting any work on computer, operating system has to be loaded in computer's memory. The process of loading the operating system in computer's memory is called booting.

Prime responsibilities of operating system are:

1. *Performing internal management functions.*
2. *Providing services.*
3. *Providing user interface.*

Following are internal management functions that are performed by the operating system:

1. *Process management functions*
2. *Memory management functions*
3. *Information management functions*
4. *Device management functions*

Services of operating system are basically the commands and applications, using which various types of tasks are performed on computer. They are part of operating system.

User interface is basically the style, in which user has to interact with computer. Generally it is of following two types:

1. *Command Line Interface (CLT).*
2. *Graphical User Interface (GUI).*

In command line interface user interacts with computer through textual commands while in graphical user interface he interacts through graphical objects like icons, menus, dialog boxes etc.

Easy to use, reliability, speed and efficiency, reusability, security, adaptability, compatibility, multi media support etc. are few most desirable characteristics of operating system.

Operating systems can be broadly classified into following categories:

1. ***Single user operating systems:*** *Single user operating systems are those operating systems, which allow only one user to work on the system at a time. MS-DOS, Windows etc. are examples of single user operating systems.*

2. ***Multi user operating systems****: Multi user operating systems allow multiple users to work on the system simultaneously. Linux, UNIX etc. are examples of multi-user user operating systems.*

3. ***Network operating system:*** *A network operating system is an operating system, which includes special functions, protocols and device drivers for connecting the computers of the network. Windows-NT, Windows-2000, Windows-3000 etc. are examples of network operating system.*

EXERCISES   **CHAPTER 5**

Short Type Questions

A. Select best possible options for following questions:

1. Which software activates the computer?

    (a) Commands   (b) User Interface

    (c) Operating System   (d) Utilities

2. What is booting?

   (a) Carrying out a self test   (b) Loading operating system in computers memory

   (c) Checking computers memory   (d) Executing a command

3. Which of the following management function is not performed by operating system?

   (a) Information management   (b) Software management

   (c) Device management   (d) Memory management

4. Which of the following is single user multitasking operating system?

   (a) MS-DOS   (b) Windows-XP

   (c) Windows-2000   (d) Unix

5. Which of the following is not a GUI component?

   (a) Radio button   (b) Menu

   (c) Command   (d) Text box

6. Which type of user interface does MS-DOS provide?

   (a) GUI   (b) CUI

   (c) ABI   (d) MGI

7. Which type of user interface is provided in Windows-XP?

   (a) GUI   (b) CUI

   (c) ABI   (d) MGI

8. What that feature is called, which permits a user to execute multiple programs simultaneously?

   (a) multi user   (b) multi tasking

   (c) multi programming   (d) multi process

9. Maximum how many options can be selected from a radio button list?

   (a) As many as required   (b) all the option present in list

   (c) 1   (d) 0

10. Maximum how many options can be selected from a check box list?

    (a) As many as required   (b) all the option present in list

    (c) 1   (d) 0

B. Fill in the blanks:

11. .... is the software, which enables the computer to perform read / write functions.

12. That user interface, in which user interacts with computer, using commands is called ....

13. That user interface, in which user interacts with computer, using graphical items is called ....

14. .... is an example of network operating system.

15. .... is an example of multi user operating system.

16. GUI is acronym for ....

17. .... command of MS-DOS will be used to view the names of all the files present in current directory.

18. Directory in MS-DOS serves same purpose, which .... does in Windows.

19. In Linux .... command is used for creating a new directory.

20. In MS-DOS .... command can be used for viewing the contents of a file.

C. State true or false:

21. The term, Windows-9x is used as common name for Windows-2000, Windows-3000 etc.

22. MS-DOS is single user, multi tasking operating system.

23. Windows is single user multi tasking operating system.

24. Unix provides CUI interface to interact with computer.

25. Process management function is one of the responsibilities of operating system.

26. Multi-user operating system and Network operating system, both, provide the facility that multiple users could use the same system.

27. Windows-2000 is an example of multi user operating system.

28. In GUI, user has to type command for interacting with computer.

29. Writing data and reading it are the activities, which fall into the category of memory management that operating system performs.

D. Answer the followings question in short:

30. In which type of user interface, user has to type the command to interact with computer?

31. In which type of user interface, user has to interact with computer through graphics and pictures?

32. Name at least four types of management functions that operating system performs.

33. Name any two operating systems, which are multi-user operating systems.

34. Name any three operating systems that are network operating systems.

35. Name that program of Windows, using which small text files are created.

36. What do you call that software, which activates computer?

37. What do you call that process, which loads the operating system into computer's memory?

38. Name any five GUI components that are generally provided in any GUI based operating systems.

39. What does the term Windows-9x signify?

40. What is Windows-NT?

E. Answer the following questions in detail:

41. What is operating system and what is its purpose? Name any four popular operating systems?

42. What do you understand by following? Explain them in brief, giving a suitable example:

    (a) Process management function. (b) Information management function

43. What is booting? Why it is required?

44. What is the function of following MS-DOD commands? What are their equivalent commands in Linux?

    (a) DIR   (b) CD   (c) TYPE   (d) COPY

45. How MS-DOS is different from Window? Give at least four arguments.

46. Describe multitasking feature? What is plug and play feature of Windows operating system?

47. What do you understand by multi user feature of operating system? Name any two operating systems that support this feature.

48. What is CUI interface? Explain it by giving a suitable example.

49. What is GUI interface? Explain it by giving a suitable example.

50. Describe at least three features of multi-user operating systems. How multi-user operating systems are different from network operating systems?

51. Describe object embedding features of Windows.

52. Describe object linking feature of Windows.

53. Differentiate between object embedding and object linking features of windows.

54. Describe cut, copy and past features of Windows.

55. Explain at least 5 new features of Windows-XP.

56. Describe at least 5 most desirable features of operating system.

57. What do you understand by reliability and adaptability of operating system.

58. Describe similarities and differences in file naming conventions of MS-DOS and Windows.

59. What is directory? What are its advantages? Name any three directory related commands of MS-DOS.

60. Describe at least three features of Windows. Name any three applications of Windows and their uses.

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